# Final Remedial Action Report

## Granite City, Illinois

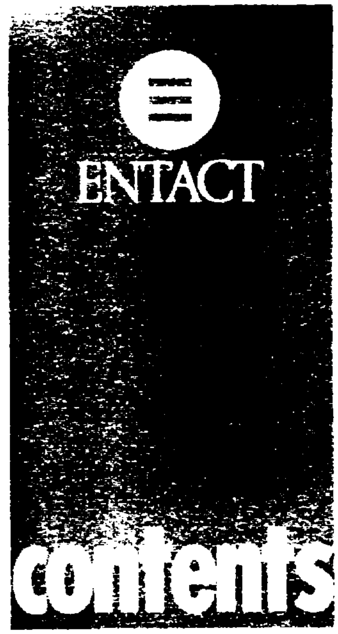
- **Prepared for**
  **NL Industries/Taracorp Superfund Site Group**
- **Prepared by**
  **ENTACT, Inc.**
- **February 20, 2000**

ENTACT

LEADING THE NATION IN CUSTOMER CARE

**Taracorp Pile & Industrial Area**

EPA Region 5 Records Ctr.
258771

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# Section one

Section 1

# 1.0 INTRODUCTION

In accordance with the Consent Decree (CD), the Record of Decision (ROD) and the Decision Document/Explanation of Significant Difference (DD/ESD) for the industrial portion of the National Lead Industries (NL)/Taracorp Superfund Site ("the site") in Granite City, Illinois, this Final Remedial Action Report has been prepared by ENTACT, Inc. (ENTACT) on the behalf of the Settling Defendants for the United States Environmental Protection Agency (USEPA), Region 5. The remedial action (RA) was conducted at the site from March 22, 1999, to February 5, 2000, in accordance with the ENTACT RA Workplan and the U.S. Army Corps of Engineers (USACE) Design Specifications, with USEPA/USACE-approved modifications based on field conditions.

The purpose of this report is to summarize the procedures and methodologies followed during the remedial activities, present the analytical results that confirm that the performance standards have been met, and provide the final engineering schematics associated with cap construction to document that the required technical specifications were followed. ENTACT's registered professional engineer and the Group's project coordinator have reviewed this report and concur that the remedial action has been completed in full satisfaction of the requirements of the Consent Decree.

## 1.1 Site Description and History

The NL/Taracorp Superfund Site consists of approximately 16 acres in an industrial area of Granite City, Illinois. The general site location is presented in Figure 1-1. The main industrial facility, located at 16$^{th}$ Street and Cleveland Boulevard, operated as a secondary lead reclamation facility from 1903 until 1983. During this time, materials from facility operations were stockpiled on site, referred to in this report as the Taracorp pile. The site also encompasses two smaller parcels consisting of a trucking company facility (BV&G Trucking Company) and a fuel oil distributor (Rich Oil).

In June 1981, St. Louis Lead Recyclers, Inc. (SLLR) began to segregate materials from the facility operations in order to reclaim recyclable lead-containing materials, hard rubber battery cases, and plastic battery cases. The SLLR operations ceased in June 1983 leaving a second pile of battery debris referred to in this report as the SLLR pile.

One of the primary objectives of the RA was to address the lead-impacted Taracorp and SLLR piles that remained on site from former facility operations. The piles had a combined volume of approximately 91,000 cubic yards, with blast furnace slag accounting for approximately 80 percent of the material. The remainder of the material consisted of broken battery casing material, lead oxide dust, and drummed dross. The USEPA classified the material contained in both piles as hazardous waste, based on the results of Extraction Procedure toxicity analyses for lead.

In December 1982, the USEPA proposed the site for inclusion on the National Priorities List (NPL). In May 1985, NL Industries, a former owner of the site, voluntarily entered into an Agreement and Administrative Order by Consent with USEPA and the Illinois Environmental Protection Agency (IEPA) to perform a remedial investigation/feasibility study (RI/FS). The site was included on the NPL in 1986. NL Industries initiated the remedial investigation in January 1987. The USEPA selected the remedy for the site and issued a ROD in March 1990 and a Unilateral Administrative Order (UAO) in November 1990. After USEPA rejected the Potentially Responsible Parties (PRPs) offer to perform a portion of the required work, USEPA initiated remedial activities at the site. To facilitate and prioritize remedial activities, USEPA divided the site into the following three areas of concern:

<u>Main Industrial Area</u>
The main industrial properties consist of approximately 30 acres that formerly contained the secondary lead smelting facility (previously NL Industries/ Taracorp, now Metallico), a slag pile recycling operation (previously SLLR, now Trust 454), a trucking company (BV&G Transport), and a fuel oil distributor (Rich Oil), two waste piles containing lead-contaminated materials, and the area of contamination surrounding the piles.

<u>Adjacent Residential Areas</u>
The residential areas are adjacent to the main industrial properties and include approximately 500 acres within the cities of Granite City, Venice, and Madison, Illinois.

<u>Remote Fill Areas</u>
The remote fill areas include properties in the Eagle Park Acres subdivisions, where battery casing materials containing lead were used as fill and paving material in low areas. The remote fill areas also include most of the alleys in Venice Township (south and southeast of Madison), Slough Road, several locations in Granite City and one area in Glen Carbon, Illinois.

The USEPA hired Woodward Clyde Consultants to conduct a site investigation and issue a report providing the results of the soil sampling activities on the industrial site. USEPA subsequently employed the USACE to do the following:

1) Complete the remedial design and perform the removal of lead-contaminated soils and battery chips in the adjacent residential areas and remote fill areas in Granite City, Venice and Madison associated with the NL/Taracorp Site; and
2) Complete the remedial design for the Taracorp pile and industrial area.

In 1994, the USEPA reopened the ROD and again accepted public comments. In September 1995, USEPA reaffirmed the remedial action plan, and added a groundwater containment component in a Decision Document/Explanation of Significant Differences.

In July 1998, the group of USEPA-identified PRPs, collectively known as the NL/Taracorp Superfund Site Group (the Group), retained ENTACT to complete the remaining residential lots and remote fill areas with USEPA and USACE as project oversight. Later in October 1998, the Group submitted a letter to EPA naming ENTACT as its supervising contractor for remediation of the Taracorp pile and related activities at the industrial site. Following receipt of USEPA's approval, the Group tasked ENTACT to perform remedial activities associated with the remediation of the Taracorp pile and related activities.

## 1.2 Scope and Description of Remedial Action

### *1.2.1 Main Objectives*

The objective of the remedial action (the RA) at the Taracorp pile and industrial area was to implement the remedial design (RD) prepared by the USACE. The RD included:

- Consolidation of all on-site hazardous material into the Taracorp pile;
- Construction of a new cell with an engineered RCRA-grade liner and a leachate collection system;
- Construction of an engineered RCRA-grade cap over the entire pile;
- Construction of stormwater and erosion controls on and around the capped pile; and
- Restoration of the site.

The remedial activities performed by ENTACT included modifications to the original USACE design, as approved by both the USEPA and the USACE prior to implementation. These modifications are described in detail in this RA Report.

### *1.2.2 Hazardous Material*

The material that was integrated into the Taracorp Pile prior to cap construction included the battery casing chips from the SLLR pile, drums of investigation-dervied waste and lead dross, remote fill soils, and lead-impacted soils from within the industrial site boundaries.

### *1.2.3 Lead Performance Standard*

The lead cleanup performance standard for the NL/Taracorp site was 1,000 ppm total lead to a maximum depth of three feet. All grids that were excavated to less than three feet below ground surface (bgs) were sampled to confirm that this criterion was met. Grids excavated to the maximum three feet depth did not require confirmatory sampling.

### *1.2.4 Site Restoration*

Upon completion of the excavation of contaminated soil containing total lead concentrations above the performance standard, the areas were backfilled in accordance with the approved RA Workplan. Soils removed from residential properties as part of the Residential Areas RA were used as backfill in the industrial excavation areas from 0.5 feet bgs to total depth. The soils were screened prior to placement to ensure that the soils met the size requirements set forth in the USACE Specifications and that the lead concentrations were below the 1,000 ppm total lead criterion. The upper six inches of backfill used across the site consisted of clean stone. Additional restoration activities included the construction of a permanent site security fence, and grading of the site to ensure that storm water runoff was directed into the appropriate drains.

# Section two

Section 2

# 2.0 PROJECT MANAGEMENT TEAM

**USEPA Remedial Co-Project Managers**
**Brad Bradley, USEPA**
**Sheri Bianchin, USEPA**

The USEPA Remedial Co-Project Managers had the overall responsibility and final authority for all phases of remedial activities.

**U.S. Army Corps Of Engineers Construction Representative**
**Charles Settles Jr., USACE, Chicago District**

Mr. Charlie Settles served as USEPA's site contact for the project. ENTACT representatives communicated with Mr. Settles on a daily basis regarding work progress. Mr. Settles' primary function was to serve as on-site observer, providing oversight on behalf of the USEPA, and serving as the primary liaison between ENTACT and the USEPA. Mr. Settles ensured that the RA was being implemented in accordance with the RA Work Plan and coordinated proposed design modifications with the USEPA and USACE Chicago District.

**Project Coordinator**
**Jeff Leed, Leed Environmental, Inc.**

Mr. Jeff Leed acted as the liaison between the USEPA and the PRP Group. He was responsible for preparing and submitting monthly progress reports, summarizing the RA activities completed each month, problems encountered and corrective action taken, the overall progress of the work, and the tasks expected to be completed in the coming month.

**Project Manager**
**Tim Healy, ENTACT, Inc.**

Mr. Tim Healy had the overall responsibility for ensuring that the site activities were implemented and completed in accordance with the Consent Decree, Statement of Work, the RA Workplan as well as all federal, state, and local regulations. Specific responsibilities of the Project Manager included, but were not limited to, the following:

- Provided personnel and equipment required for successful completion of the remedial activities;
- Provided the Project Coordinator and USEPA RPMs the names and qualifications, of the contracted laboratory, disposal facilities, recycling facilities, and transporters used to implement the RA;
- Ensured that ENTACT's associates performed their designated duties in strict accordance with the Health and Safety Plan;
- Ensured required quality assurance/quality control procedures were properly

implemented and documented;
- Ensured that the RA was completed according to the approved schedule;
- Ensured that all documents and reports that ENTACT was required to generate met the requirements of the approved RA Workplan; and
- Communicated any request for modifications to the RA Workplan to the Project Coordinator and USEPA.

**Project Superintendent**
**Rich Wood, ENTACT, Inc.**

The ENTACT Project Superintendent reported directly to the ENTACT Project Manager and was responsible for overall project conformance to the RA Workplan, construction specifications, and project support documents. He had direct responsibility for implementing the RA Workplan and Health and Safety Plan during field activities. He was responsible for leading and coordinating the daily activities of the various project specialists under his supervision. In addition, he was responsible for adhering to work schedules, overseeing subcontractors, assisting the field team, and identifying and resolving problems at the field level. Specific responsibilities included the following:

- Monitored work at all times or designated a suitably qualified alternate;
- Ensured site workers read and understood the site-specific Health and Safety Plan;
- Ensured the site workers possessed the required documentation of their safety training and medical monitoring;
- Conducted daily safety meetings, ensured that more extensive safety meetings were held at the start of new project activities, and performed day-to-day health and safety functions;
- Ensured that required air monitoring was conducted in accordance with the approved Workplan and the Health and Safety Plan;
- Prepared safety reports and other health and safety documentation; and
- Communicated any concerns or health and safety issues with the Project Manager and ENTACT's Corporate Health and Safety Director.

**On-Site Field Managers**
**Doug Davenport, Greg Parker, Rob Santoro, ENTACT, Inc.**

The on-site field managers were responsible for directing all site personnel, equipment, subcontractors, and activities to ensure the successful implementation of the remedial activities. Specific responsibilities of the Field Project Managers included the following:

- Supervised field activities and ensured that the construction activities were executed in accordance with the RA Workplan;
- Ensured that adequate resources were available on-site to complete required tasks and meet required Performance Standards;
- Ensured ENTACT associates and qualified subcontractors were properly trained in the safe performance of the tasks which they are assigned;

- Ensured required record keeping, project record documents, and other related documents were maintained on-site;
- Assisted others in the planning, coordination, and implementation of the remedial activities;
- Communicated with the project manager and other site superintendents to remedy problems to ensure agreement on the tasks to be performed each day, and monitored compliance with the approved Workplan and Federal, State, and Local regulations; and
- Redirected the sequence of site work and specifics of work procedures and protocols in response to modified or unforeseen field conditions to accomplish task objectives in the most efficient and safe manner possible.

**On-Site Quality Assurance/Quality Control Officer,**
**Dan Rest, ENTACT, Inc.**

Mr. Dan Rest was responsible for performing required quality control testing at the site such as geotechnical testing, XRF screening, confirmatory sample collection, and air monitoring sample collection. The on-site Quality Assurance/Quality Control (QA/QC) Officer operated independently of ENTACT's Project Superintendent and Field Project Managers. The QA/QC Officer communicated any QA/QC issues related to the site to the Project Manager and Regulatory/Technical Specialist. He had the authority to correct and implement additional measures to assure compliance with the RA Workplan, including the QAPP. Specific responsibilities included:

- Adherence to the QAPP;
- Adherence to the QCPP
- Observed daily site activities and monitored for potential site issues such as health and safety, dust control, site security, etc.;
- Corrected or discontinued any potentially unsafe work practices or site conditions;
- Secured necessary sampling tools, bottles, packaging/shipping supplies, chain-of custody documents, etc. in accordance with the approved workplan;
- Collected or directed the collection and shipment of samples at the frequencies and for laboratory analysis parameters specified in the QAPP;
- Documented the location, time, and date of all samples that were collected and shipped to the laboratory;
- Interfaced with the superintendents so that the sample collection was coordinated with the general progression of the work;
- Notified the project manager, project coordinator, and USEPA of any sampling activities associated with the implementation of the Workplan; and
- Obtained analytical results for review and reporting.

**Corporate Health and Safety Director**
**Don Self, ENTACT, Inc.**

The Corporate Health and Safety Director coordinated and provided oversight for the

Health and Safety issues at the site. He was responsible for conducting the Health and Safety Orientation meeting before the RA was implemented. He reviewed weekly health and safety updates from the site and conducted several inspections at the site during the RA.

**Regional Health and Safety Supervisor**
**Jules Hodgson, ENTACT, Inc.**

Ms. Hodgson was the Site Health and Safety Supervisor and was responsible for the overall Health and Safety Program at the site, providing technical support and oversight for all H&S issues. She was present at the site on numerous occasions to ensure the HASP was being implemented properly. If and when site conditions did not warrant the daily presence of a Health and Safety officer, her duties and responsibilities were delegated to an alternate Health and Safety Officer.

**Regulatory /Technical Support**
**Pat Vojack, ENTACT, Inc.**

Ms. Vojack provided technical support to the Project Manager in ensuring that the site activities were implemented and completed in accordance with the Consent Decree, Statement of Work, the RA Workplan, and federal, state, and local regulations. She also provided technical support to the Project Superintendent in the areas of wastewater management, solid and hazardous waste management, and air monitoring for the RA. Specific responsibilities included, but were not limited to, the following activities:

- Provided technical support and direction for the implementation of the required remedial activities;
- Ensured required quality control testing was performed and documented, and the results were provided to the ENTACT project management team and USEPA in accordance with the requirements of the Workplan;
- Provided oversight and direction to the on-site QA/QC Officer; and
- Provided assistance in the modification of technical requirements of the remedial activities, if necessary.

**Engineering Consultant**
**Patrick Engineering Inc., Lisle, Illinois**

Patrick Engineering is a professional engineering firm in the State of Illinois. Chip Parrott and Jack Steenken, Registered Professional Engineers in the State of Illinois, reviewed all engineering aspects of the landfill design and were responsible for the design of field modifications to the cap, retaining wall and drainage plan, and ensured construction quality assurance requirements were met.

Specific duties included:

- Provided engineering support and direction for the implementation of the landfill cap;

- Ensured required quality control testing was performed and documented and that the results provided to the ENTACT project management team and USEPA in accordance with the requirements of the RA Workplan;
- Provided oversight and direction to the construction field crew; and
- Provided assistance in the modification of engineering requirements of the remedial activities if they differed from the technical requirements in RA Workplan.

**ENTACT Field Technical Staff**

The Field Technical Staff for this project was selected from ENTACT's team of hazardous materials technicians, as well as technicians from the Superfund Job Training Institute. The Technical Staff possessed OSHA 40-Hour Hazardous Waste Operations training. All of the designated team members were experienced professionals who possessed the degree of technical competence required to perform the required work.

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# Section three

Section 3

# 3.0 MOBILIZATION

Mobilization for the RA at the NL/Taracorp Site began on March 22, 1999. Key mobilization activities included the development of a Support Zone and site headquarters, establishment of the Exclusion Zone and decontamination facilities, delineation of the site area into grids for sampling and excavation purposes, clearing and grubbing of the site, and locating underground and overhead utilities at the site.

## 3.1 Pre-Construction Conference

A pre-construction conference was held on March 29, 1999 at the ENTACT Granite City office. In attendance were representatives of the USEPA, USACE, and ENTACT's field and administrative team. The Group's Project Coordinator was present via teleconference. The scope of work, health and safety issues, project scheduling, sequence of field task implementation, and proposed engineering design modifications were discussed. Also discussed were community relations, including planned measures for dust control and the high level of public and media interest in this site.

## 3.2 Installation of Support Facilities

The Support Zone was approximately 100 feet long by 50 feet wide and consisted of the project trailers and a personnel parking area, as illustrated in Figure 3-1. The area was excavated to the maximum three feet depth and backfilled between March 22 and 24, 1999 prior to placement of the support facilities. All excavated soils were stockpiled in the area immediately to the west of the Support Zone, and were later deposited in the Taracorp Pile.

The Support Zone was equipped with two office trailers and a decontamination trailer. One of the office trailers was used for ENTACT's field administration staff, and the other was used exclusively by the USACE and the USEPA. Both office trailers were equipped with electricity, as well as telephone, fax, and internet-ready computer facilities. The decontamination trailer was equipped with electricity and hot and cold running water, showers, sinks, lockers, and changing areas. One end of the decontamination trailer opened into the exclusion zone, and the other end opened into the support zone.

## 3.3 Establishment of Work Zones

A temporary perimeter fence was installed around the site on March 23, 1999 to define the outer boundary of the work exclusion zone. The fence was posted with signs indicating lead hazards and prohibiting unauthorized entry. Following the commencement of excavation, Level "C" personal protective equipment (PPE) was required for all personnel entering the exclusion zone. This included cotton coveralls, hard hat, half-face respirator, safety glasses, steel-toed work boots, and gloves.

### 3.4 Establishment of Coordinate Grid System

A coordinate grid system (CGS) was established over the entire site, in accordance with the Workplan, as illustrated in Figure 3-2. The CGS was composed of 205 individual 50-foot by 50-foot grids. Due to the irregular geometry of the site, the grid pattern was not uniform throughout the site. The purpose of the CGS was to provide a means of tracking and documenting excavation activities and identifying sample locations.

### 3.5 Construction of Decontamination Pad

A pad for equipment and vehicle decontamination was constructed at the gated entrance to the site, off State Street, as illustrated in Figure 3-1. The pad consisted of a pre-cast concrete retention box set into the ground and surrounded by an asphalt apron sloped toward the box. The purpose of the retention box was to retain decontamination water generated during field activities. The decontamination water was pumped from the retention box periodically and dispersed on the site for dust suppression in lead-impacted areas.

### 3.6 Clearing and Grubbing

Prior to excavation, the site was cleared and grubbed of vegetation and small trees that would interfere with remedial activities. Care was taken to preserve as many trees and shrubs as possible. Much of the clearing and grubbing was done at the northern end of the site, around the area of the Taracorp Pile. All vegetation was cut so that the stump was flush with the ground level. In accordance with the Workplan, all felled foliage was ground up with a chipper and placed on the Taracorp pile.

### 3.7 Removal of Overhead Power Lines

A representative of Illinois Power was brought onto the site to identify overhead power lines present in proposed work areas that could be removed or relocated prior to remedial activities. These lines were subsequently de-energized and removed by an Illinois Power crew.

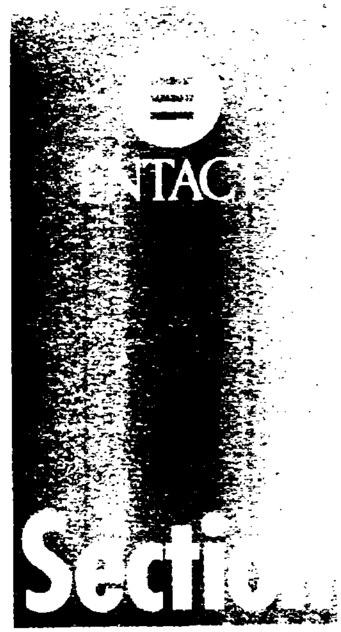
A high-tension power line that ran across the western edge of the site had to be relocated because a number of its poles were located inside of the footprint of the Taracorp Pile. A corresponding set of poles was erected approximately 50 feet from the original poles, and the power line was moved.

### 3.8 Locating of Underground Utilities

The Joint Utility Locating Information for Excavators (JULIE) was contacted prior to initiating excavation activities in order to locate all known underground utilities. Representatives from the telephone and power companies came to the site and clearly marked all telephone, electric and natural gas lines.

### 3.9 Relocation of Metallico Asphalt Road

Trucks servicing Metallico had to be re-routed because the original route interfered with ENTACT's remedial operations in the immediate vicinity of the Taracorp Pile. ENTACT constructed an alternate asphalt road on the Metallico property to reroute the truck traffic closer to the Metallico building. The road was constructed to allow sufficient room for a tractor-trailer to pass another vehicle if required.



# Section four

Section 4

# 4.0 REMEDIAL ACTION

## 4.1 Overview

The RA field activities at the NL/Taracorp site began on March 22, 1999, and were completed on February 5, 2000. All excavation and consolidation of contaminated material and cap construction were completed by August 6, 1999. Final restoration activities were finished on February 5, 2000.

The major remedial activities included excavation of the on-site lead-impacted soils, excavation and lining of a new landfill cell, consolidation of all on-site impacted material into the Taracorp Pile, application of an engineered RCRA-compliant cap, construction of storm water controls, and site restoration. In addition, other ancillary activities were conducted in order to facilitate the main Remedial Action components. These activities included dust control, personnel and equipment decontamination, site surveying, and QA/QC and Health and Safety activities.

## 4.2 Excavation

Prior to excavation, a coordinate grid system (CGS) was established across the site with grid intervals of 50 feet by 50 feet. The CGS consisted of 205 individual grids, as illustrated in Figure 3-2 and described in Section 3.4. Due to the irregular geometry of the site, the grid pattern was not uniform throughout the site.

During the excavation of each grid, the excavation floor was monitored using an X-Ray Fluorescence (XRF) field-screening instrument to determine lead concentrations. If the XRF instrument indicated that the cleanup standard of 1,000 ppm had been reached before the three-foot maximum depth was reached, excavation was considered complete and a confirmatory sample was collected for laboratory analysis to verify that the performance standard had been met. Based on XRF field screening readings, if the excavation continued to the maximum removal depth of three feet, excavation was terminated in that grid and no confirmatory sample was required.

Confirmatory soil samples consisted of a four-part composite sample aliquot, formed by collecting one grab sample from each of the four quadrants of the grid. In grids that were partially obscured by structures such as buildings, the four-part composite aliquots were collected around the structures. All confirmatory soil samples were sent to Environmetrics in St. Louis, Missouri for total lead analysis. Sample methodology is discussed in detail in Section 5.3.

Approximately 66,000 cubic yards of soil/debris was excavated from the site during the RA and consolidated into the Taracorp Pile. All excavation was performed using hydraulic excavators, and the material was transported to the pile in off-road articulating dump trucks. With USACE approval, excavation was not conducted within five feet of monitoring wells 103 and 103-91, located in Grid 198, nor in the immediate areas of known underground utilities.

## 4.3 Material Consolidation

In addition to the excavated soils, additional materials were consolidated into the Taracorp Pile as a part of the RA. These materials included the SLLR Pile of battery casing chips, on-site drums of investigative derived waste and lead dross, and remote fill soils.

### *4.3.1 SLLR Pile of Battery Casing Chips*

The SLLR Pile consisted of approximately 5,800 cubic yards of lead-contaminated battery casing chips that were generated by lead-acid battery recycling operations conducted by SLLR between 1981 and 1983. This pile was moved and consolidated into the Taracorp Pile between April 14 and April 16, 1999.

Movement of the pile was accomplished using an excavator and two articulating dump trucks. The SLLR material was staged on the eastern edge of the top of the Taracorp pile. Upon completion of the liner on the landfill extension, the SLLR material was pushed down onto the new liner.

### *4.3.2 Drums of Contaminated Material*

Approximately 80 drums of material were located directly to the west of the Taracorp Pile prior to the RA. A total of 40 drums contained investigative-derived wastes from prior site investigations. The remaining drums contained lead dross from former smelter operations and were observed to be in advanced stages of deterioration.

The investigative-derived waste drums were consolidated into the Taracorp Pile in accordance with the RA Workplan. The Workplan called for the dross-containing drums to be placed in overpack drums for shipment to a secondary lead reclamation facility. However, this was not possible due to the severely deteriorated condition of the drums as observed by both USEPA and ENTACT personnel during the Pre-Construction Meeting. Therefore, a modification was made to the Workplan, with Agency approval, to incorporate this material into the newly constructed and lined cell in the Taracorp pile.

### *4.3.3 Remote Fill Soils*

The remote fill areas included properties in the Eagle Park Acres subdivisions where battery case materials containing lead were used as fill and paving material in low areas. These areas were excavated by ENTACT as part of the Residential Area RA, and the excavated material was placed into the Taracorp Pile.

## 4.4 Removal of Underground Storage Tanks

A 20,000-gallon underground storage tank (UST) was removed from the BV&G Trucking parcel of the site on April 20, 1999. The tank was removed in accordance with the Illinois Underground Storage Tank Removal Program (35 IAC 732). Tony Biasi of ENTACT, an Illinois licensed UST installer, was on site to conduct the removal. The tank was pulled from the ground with an excavator, and taken to O'Dell's Iron and Metal in Madison, Illinois for disposal as scrap metal. An Illinois State Fire Marshall official was on hand to witness the UST removal.

After the tank was removed, soil samples were collected from the floor and sidewalls of the excavation to ensure that the surrounding soils were not impacted. A total of eight samples were collected and submitted to Test America, of Bartlett, Illinois for analysis of benzene, toluene, ethylbenzene and xylenes (BTEX) compounds and polycyclic aromatic hydrocarbon (PAH) compounds. Sampling protocol and analytical results are discussed in detail in Section 5.5.

Following removal of the 20,000 gallon UST, standard decontamination procedures were followed. The tank was ventilated to allow the release of any potential fumes that may have been present in the UST. Holes were cut in both ends of the tank to facilitate ventilation. The atmospheric conditions both inside and immediately outside the UST were monitored using a lower explosive limit (LEL) indicator and an oxygen ($O_2$) meter, prior to removal of the tank contents.

The remains of an additional UST were uncovered adjacent to the Rich Oil building during excavation on the Rich Oil parcel. The UST was found in a very deteriorated condition with an estimated original volume of 200 gallons. The UST was removed under permit on July 30, 1999, with no evidence of spills or leaks to the subsurface, and disposed of at O'Dell's Iron and Metal in Madison, Illinois. An Illinois State Fire Marshal official was on hand to witness the removal. This tank, as it was found in the ground, was crushed and did not appear to be complete. No sludge or petroleum product was found inside of the tank. Additionally, there was no evidence of discoloration or of free product in the surrounding soils.

Five soil samples were collected from the floor and sidewalls of the excavation and submitted to Test America of Bartlett, Illinois, for BTEX and PAH analysis Sampling protocol and analytical results are discussed in detail in Section 5.5.

## 4.5 Excavation and Lining of Landfill Extension

As part of the RA, in accordance to the USACE Design Specifications, the Taracorp Pile was extended to accommodate the anticipated volume of material generated by excavation and consolidation activities. This landfill extension required construction of a RCRA compliant liner and a leachate collection system.

### *4.5.1 Shaping and Preparation of the Liner Area*

The liner area was excavated and shaped to the specified grades by using screened excavated residential soils. The entire liner area was compacted according to the USACE Specifications by making a minimum of five passes with a smooth drum, vibrating roller for every twelve-inch lift of fill soil applied. The grade of the liner area was continually monitored using the site global positioning system (GPS) surveying equipment. Soils used for the final surface of the liner area were carefully monitored to ensure that no vegetation, rocks, or other debris larger than two inches in any dimension would be in contact with the GCL. In addition, the surface was rolled flat so that no protrusions or chasms greater than ½ inch occurred on the surface.

### *4.5.2 Leachate Collection System*

Prior to placement of the geosynthetic layers, a five-foot by five-foot sump was excavated out of the center of the liner area. The sump was three feet deep in the center, with sides sloping up to the liner area floor. This sump served as the collection point for the leachate collection system. After the geosynthetic layers were put in place, and before any contaminated material was put into the new cell, the vertical leachate collection pipe was installed.

The pipe was four inches in diameter and had half-inch perforations three feet up from the pipe's bottom. The bottom of the pipe was capped to prevent damage to the liner materials and to facilitate pumping of the leachate. Coarse stone aggregate was placed in the sump around the pipe. A layer of geotextile was then installed on top of the coarse stone aggregate to prevent it from mixing with the protective sand layer that was to be installed over the geosynthetics.

### *4.5.3 Application of Geosynthetic Materials*

ENTACT subcontracted Environmental Specialties International, Inc. (ESI) of Baton Rouge, Louisiana, to perform all geosynthetic liner work related to construction of the liner in the Taracorp pile. The geosynthetic materials consisted of, from bottom to top, geocomposite clay liner (GCL), 60-mil textured high-density polyethylene (HDPE) liner, and a geocomposite drainage layer. A twelve-inch protective layer of sand was placed over the geosynthetics before any contaminated material was deposited into the new cell.

An anchor trench, two feet wide by two feet deep, was excavated around the perimeter of the liner area before lining activities commenced. A GCL was the bottom layer of the liner system. The GCL was placed so that panels overlapped a minimum of six inches. Granular bentonite was used to seal the overlapping seams at a rate of 0.25 pounds (lbs) of bentonite for every linear foot of seam. Care was taken to ensure that the GCL was not damaged prior to or during placement. Rolls of GCL were stored on railroad ties, approximately eight inches off of the ground. The rolls were left in their original plastic packaging. As an additional measure of protection, the rolls were covered with polyethylene sheeting.

The 60-mil, textured high-density polyethylene (HDPE) liner was then installed over the GCL as part of the liner system. The panels were overlapped a minimum of three inches and were thermal fusion seamed. Extrusion weld seaming was used in areas where seam repairs were needed, and in areas where the thermal fusion machine could not reach. Seam quality was monitored by conducting destructive seam tests, as discussed in detail in Section 7.4

The final layer of the liner system was the geocomposite drainage layer. This consisted of two layers of geotextile separated by a mesh of HDPE. The geocomposite drainage layer provided a conduit through which runoff could easily reach the leachate collection sump.

Following placement of the three geosynthetic components of the liner system, the edges were placed into the anchor trench that was then backfilled. Backfilling of the anchor trench took place in the early morning hours of the day, due to the fact that the HDPE liner could contract significantly in midday heat. A twelve-inch protective sand layer was added before any contaminated material was placed onto the liner. Extreme care was taken to ensure that heavy equipment used in the application of the sand layer did not damage the liner. Piles of sand were staged at the edge of the liner area and were pushed onto the liner by a bulldozer, whose tracks never actually came into contact with the geosynthetic materials.

## 4.6 Final Pile Design

The Taracorp pile was shaped continuously as material was added. The pile was surveyed periodically to ensure that the specified grades were met. As excavation neared completion, the pile was shaped to final grade. The top of the pile was sloped at 5%, and the pile's sides were sloped at 4:1. A cross-sectional drawing of the cap design is shown on Figure 4-1, and the final "as-built" drawings of the pile are presented in Appendix A.

***Modifications to the Pile Design***

All modifications to the original design proposed by ENTACT were submitted to both the USACE and the USEPA for approval prior to implementation. Because the final volumes of excavated material were less than originally estimated, some original design components became unnecessary, and the shape of the pile was redesigned.

The concrete retaining walls were eliminated due to the decrease in original estimated volume of excavated soil from the industrial area. The retaining walls had been intended to provide structural support for the base of the pile. A review of the actual volumes of material added to the pile indicated that the construction of retaining walls was not required. Both the USEPA and the USACE approved the elimination of the retaining walls from the cap design. The gradient of the sideslopes was not altered to accommodate the elimination of the retaining walls.

As the RA progressed, industrial area soil excavation volumes indicated that the original pile footprint was larger than necessary. Patrick Engineering of Lisle, Illinois re-designed the pile shape based on the actual volume of material, resulting in the elimination of a portion of the southern end of the pile.

Lastly, the access and maintenance road was moved from the southern end of the pile to western side of the pile. This road provides access for pile maintenance, landscaping equipment, and leachate collection activities.

## 4.7 Final Capping of Pile

Environmental Specialties International of Baton Rouge, Louisiana was contracted to perform all application of geosynthetic materials. The final cap consisted of, from bottom to top: contaminated material, random fill, GCL, linear low-density polyethylene liner (LLDPE), geocomposite drainage layer, select fill, topsoil, and seed. Capping began on July 26, 1999, and was completed on August 5, 1999. All three geosynthetic layers were laid concurrently, with a given portion of the pile receiving GCL, LLDPE liner, and the geocomposite drainage layer within the same day. This method of geosynthetic placement prevented rain damage to the GCL. The select fill clay was applied over the geosynthetics immediately following their placement.

### *4.7.1 Application of Random Fill*

After all contaminated material had been added to the pile, the random fill layer was applied. The random fill layer consisted of stockpiled residential soils generated in the Residential Area RA that had lead concentrations below the 1,000 mg/Kg cleanup standard. The purpose of the random fill is to provide a final twelve inches of material over the excavated industrial soils before the application of the GCL. The excavated residential soils classified as Lean Clay (CL), and were acceptable material for use as random fill according to Section 02211 of the USACE Specifications. The classification was determined using geotechnical test method ASTM D 2487 by Midwest Testing Inc. of Bridgeton, Missouri.

### *4.7.2 Application of Geosynthetic Clay Liner*

The GCL was applied in accordance with Section 02242 of the USACE Specifications. Installation followed the final grading and compaction of the random fill layer. The GCL was delivered to the site in rolls and brought to the pile suspended from the bucket of a wheel loader. The sections of GCL were then rolled out onto the pile. Panels of GCL were laid so that they overlapped by at least six inches. Granular bentonite was poured between overlapping GCL sheets at the rate of no less than 1/4 pound of bentonite per linear foot of seam. To avoid potential exposure to rain, the GCL was not applied to the entire pile before the liner was applied. Instead, a portion of the pile was covered with GCL then covered with the LLDPE liner the same day so that the GCL was not exposed to rain overnight.

### *4.7.3 Application of 40-mil Textured LLDPE Layer*

Installation of the LLDPE liner was done in accordance with Section 02271 of the USACE Specifications. All sections of GCL installed on a given day were also covered with the 40-mil, textured LLDPE impermeable layer. The seams on this layer were overlapped a minimum of three inches and were sealed by thermal fusion. For sections where repair of seams was necessary, (including areas selected for destructive seam testing, or where the thermal fusion machine could not reach) extrusion welding was used. The QA procedures used during the application of the LLDPE liner is covered in detail in Sections 7.3 and 7.4. All rolls of LLDPE were stored off of the ground on railroad ties and were covered with polyethylene sheeting for protection.

### *4.7.4 Application of Geocomposite Drainage Layer*

The geocomposite drainage layer consisted of a HDPE geonet sandwiched between two layers of geotextile, designed to act as a conduit for infiltrating water to flow down the pile. The geocomposite drainage layer was installed in accordance with Section 02273 of the USACE Specifications. All rolls of geocomposite were stored off of the ground on railroad ties and were covered with polyethylene sheeting for protection from the elements. Following application of this layer, the edges of all three geosynthetics were placed into the anchor trench, and the trench was backfilled.

### *4.7.5 Application and Grading of Select Fill and Topsoil*

A total of 26,700 cubic yards of select fill was applied to the pile to construct the 18-inch thick select fill layer that overlies the drainage layer. The fill was brought to the site in dump trucks and applied using bulldozers. The select fill was pushed "up" the pile so that no piece of heavy equipment came into contact with the geosynthetics. It was applied and compacted in accordance with Section 02223 of the specifications.

A six-inch layer of topsoil was then applied onto the select fill, in accordance with Section 02223 of the specifications. A total of 6,300 cubic yards of topsoil was applied to the pile. The topsoil was not compacted following placement, in accordance with the design specifications.

## 4.8 Construction of Stormwater Controls

The landfill stormwater management system consisted of three components: vegetation on the pile for erosion control, a retention pond for the collection of storm water runoff, and a perimeter channel to collect stormwater from all sides of the pile.

After application of the topsoil, the pile was seeded in accordance with Section 6.6.6 of the approved RA Workplan. The pile was seeded with a combination of annual rye, turftype tall fescue, Kentucky bluegrass, and wildflower seeds. In addition, as a measure of erosion protection for the winter months, erosion mats were laid on the pile. These mats served as a vegetative cover for the interim period before the spring growing season.

The retention pond was constructed on the eastern side of the pile. It was approximately 60 feet wide by about 440 feet long by 4 feet deep and can hold an approximate volume of 790,000 gallons of stormwater. Water in the pond flows toward the southern end, where a pre-cast concrete drain then conveys the water to the municipal sewer system. A layer of large stone surrounds the concrete drain. The retention pond is designed to accommodate the runoff from the pile associated with a 25-year storm event.

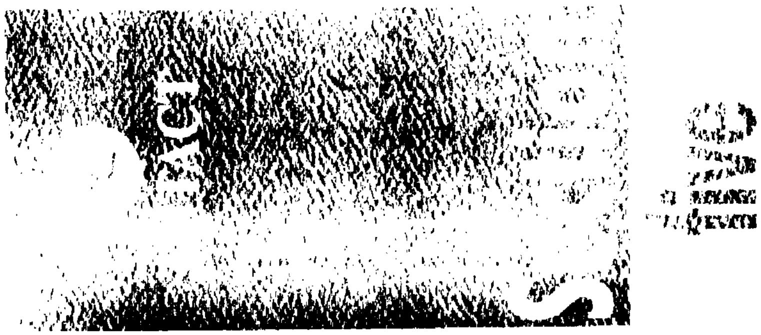
A drainage channel runs around the perimeter of the pile in all areas not abutting the retention pond. The drainage channel consists of concrete measuring six inches deep by two feet wide. It is designed to carry the flow anticipated by a 25-year storm event, based on historical weather data from the Granite City area. The channel empties into the retention pond on both the north and south ends. The retention pond and the drainage channel are illustrated in the Final Liner Grading Plan for Area A presented in Appendix A-1.

Stormwater was managed on remaining areas of the industrial property by means of careful grading and by the placement of drains into which runoff would flow. The final site grades and placement of stormwater runoff drains are provided in the Final Liner Grading Plan for Area B in Appendix A-2.

### 4.9 Backfilling and Site Restoration

All excavated areas on the site were backfilled to the grades specified on the drawings prepared by the USACE and by Patrick Engineering. The material used as backfill consisted of screened material generated by the residential portion of this project. Additional granular material was brought onto the site and used as fill. All backfill was compacted according to the requirements in the specifications. Fill was placed in loose lifts of 12 to 15 inches and compacted using both smooth drum and “sheep’s foot” vibratory rollers. Areas receiving pavements had the upper fill layers compacted to 95% of maximum density based on a modified proctor test, ASTM D 1557.

Additional site restoration activities included the construction of a permanent fence around the perimeter of the Taracorp pile and industrial area, replacement of a sign for State Street Warehouse that was temporarily removed during construction, removal of the concrete decontamination water retention box, removal of the temporary exclusion zone and decontamination zone fencing, and construction of the final site security fence.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five

# 5.0 CHEMICAL QUALITY ASSURANCE/QUALITY CONTROL

## 5.1 Introduction

One of the major components of the QA/QC program for the NL/Taracorp Site was the Chemical QA/QC. The Chemical QA/QC included the following:

- XRF screening of the excavation and stockpiled residential soils to determine whether the lead concentrations was below the performance standard of 1,000 mg/Kg total lead for the industrial site;
- Air and confirmatory soil sampling during underground storage tank removal;
- Confirmatory soil sampling in grids excavated less than the three foot maximum removal depth to verify that the performance standard of 1,000 mg/kg had been met;
- Air sampling to monitor the work areas for health and safety purposes and the perimeter of the site to ensure air quality performance standards were achieved; and
- Sampling of imported backfill to ensure the materials met the requirements specified in the RA Workplan.

All laboratory analyses was conducted by Environmetrics, Inc. of St. Louis, Missouri, with the exception of the UST analytical, which was performed by Test America of Bartlett, Illinois. This program followed the approved Field Sampling and Analysis Section of the RA Workplan, as well as the approved Quality Assurance Project Plan. The analytical results for all sampling associated with the RA are summarized in Appendix B with the complete original data packages retained in the project files at the ENTACT, Wood Dale Illinois office.

## 5.2 X-Ray Fluorescence Field Screening

An XRF instrument was used to guide the depth of soil excavation at the industrial site. A member of the QA/QC team was present in the excavation area to screen the excavation floor with the XRF instrument and determine if further excavation was necessary. The XRF instrument was used only as a field screening device to guide the excavation and not as verification that the performance standard had been met. All areas excavated to less than three feet below ground surface were sampled for off-site laboratory analysis of total lead to verify that the cleanup criteria had been met.

The XRF was calibrated daily before use. Calibration included analysis of a pure element standard, a "blank" standard, and three site-specific standards. The site-specific standards were soils of varying lead concentrations, collected from the site, and analyzed by the lab. A summary of the site-specific standard analytical results is presented in Appendix B.

The values obtained by the laboratory analysis became the "true" values for the standards. These "true" values were compared to those obtained by the XRF each day. If the XRF value differed from the site-specific standard by more than 20%, an internal energy calibration was run on the machine, restoring it to its proper calibrated state. A total of fifteen site-specific standards were collected from the site. Each day, three of the standards were run to ensure the machine's proper calibration.

## 5.3 Grid Confirmatory Soil Samples

The majority of grids were excavated to the maximum depth of three feet. Grids excavated to a depth of less than three feet below ground surface were sampled in order to confirm that the 1,000 mg/Kg lead criterion had been met. Sampling was conducted in accordance with Section 5.4.2 of the approved Field Sampling and Analysis Plan. A four-part composite sample was collected from the four quadrants of each grid, homogenized, and placed into a clean laboratory-supplied sample container and delivered to Environmetrics, Inc. of St. Louis, Missouri for analysis of total lead using EPA Method 6010B. Results of the confirmatory samples can be found in Appendix B-2 and illustrated in Figures 5-1a and 5-1b.

Confirmatory soil samples were taken from a total of 89 grids. The remaining grids on the site were excavated to the maximum removal depth of three feet bgs. Of the 89 samples, 7 samples yielded results of greater that 1,000-mg/Kg lead, indicating that grid required further excavation. Additional excavation was conducted in the seven grids that showed sample results above the performance standard to the maximum removal depth of three-foot depth.

## 5.4 Residential-Generated Fill Samples

Excavated soils from the residential portion of this project were stockpiled on the Industrial Site. These stockpiled soils were sampled for total lead in accordance with Section 5.6.1 of the Field Sampling and Analysis Plan, prior to placement. If the lead concentration was determined to be below the performance standard of 1,000 mg/Kg for the industrial site, the soils were used as fill on the site and on various parts of the cap construction.

One soil sample was collected for every 500 cubic yards of stockpiled soils, in accordance with Section 5.6.1 of the Field Sampling and Analysis Plan. Each composite sample consisted of four grab sample aliquots of material collected from each side of the pile at varying depths, and were homogenized and placed in laboratory-supplied sample containers for off-site analysis of total lead. Table B-3, in Appendix B, presents the analytical results. As indicated in Table B-3, none of the samples yielded results of greater than 1,000 mg/Kg total lead. The average of the residential fill samples was 426 mg/Kg total lead. The soil represented by those samples containing lead at concentrations greater than 500 mg/Kg lead were placed in the base of the excavation to a maximum height of 0.5 foot below grade with the final six inches of backfill composed of clean imported fill material.

## 5.5 Underground Storage Tank Confirmatory Soil Sampling

Upon removal of the 20,000-gallon UST, soil samples were collected from the excavation floor and sidewalls in accordance with Section 5.5 of the Field Sampling and Analysis Plan. Eight samples were collected from the UST excavation area: two from the floor, one from each end sidewall, and two from each side sidewall.

The soil samples were analyzed for BTEX and PAH compounds by Test America of Bartlett, Illinois. Samples collected for BTEX analysis conformed to the requirements of EPA Method 5035. A fixed-volume (5 cc) core of material was collected using a disposable syringe and placed directly into the laboratory-supplied vial containing a pre-measured volume of preservative. The samples analyzed for PAH compounds, using EPA Method 8270, were placed directly in 4-ounce glass jars. Table B-4, in Appendix B, shows the results of these analyses. No detectable levels of BTEX were found in any of the samples. Trace levels of PAH compounds were detected in one of the eight samples at levels below the Illinois Tiered Approach to Corrective Action Objectives (TACO) Tier 1 industrial/commercial criteria.

In addition to the 20,000-gallon UST, portions of a second UST were removed from the ground on the site. The removal of this UST is discussed in Section 4.4 of this Report. Samples were collected from the excavation area for BTEX and PAH analysis. Table B-4 shows the results of these analyses. Trace levels of BTEX and PAH compounds were found in four of the five soil samples at levels below the Illinois Tiered Approach to Corrective Action Objectives (TACO) Tier 1 industrial/commercial criteria.

## 5.6 Imported Backfill Samples

Both the select fill soil and the topsoil were imported to the site from off-site sources by C. Grantham Company. As a result, it was necessary to sample these soils to ensure that they met the requirements for imported fill sources as allowed by the USEPA at similar lead refinery facilities under Superfund in Region V.

The select fill and the topsoil each came from a single source. Composite samples were collected from each of the sources was sampled before the material was applied to the pile. Each composite samples consisted of four aliquots of material, in accordance with the requirements set forth in the approved Field Sampling and Analysis Plan.

The samples were analyzed for the eight RCRA metals, volatile organic compounds (VOCs), pesticides and polychlorinated biphenyl compounds (PCBs), and total petroleum hydrocarbons (TPHs). Results of these samples can be found in Table B-4 in Appendix B.

## 5.7 High-Volume Air Monitoring

High-volume air monitoring was conducted to determine the effectiveness of the field dust suppression measures and to ensure the air quality performance standards had been met. Two forms of high-volume air monitoring were conducted: Total Suspended Particulate (TSP) and 10-micron particulate matter ($PM_{10}$).

Four high-volume air monitoring stations (Station 1 through 4) were set up on the four corners of the site. The locations of the stations can be seen in Figure 3.1. The stations consisted of scaffold platforms, approximately five feet off of the ground, which were anchored into the ground to prevent wind topping. Each scaffold platform held a $PM_{10}$ and a TSP monitor. The two monitors were placed on the platforms at least six feet apart, and were positioned on the site so that airflow around them was not obstructed by any structures, such as trees or buildings. The monitors were placed at least twice as far from any object as the object was tall. Station 4 was placed just outside of the exclusion zone, on the Metallico Property, in order to position the monitors close to the pile, where potential air-borne lead and dust emissions were a primary concern. A conservative assumption was used for this Site that all of the TSP collected on the filters was lead dust.

### *5.7.1 TSP Air Monitoring*

The TSP monitors ran continuously during work activities and filters were changed daily. Each filter sample represented 24 hours of monitor time. All TSP filters were sent to Environmetrics for analysis of total lead and total suspended particulate. The results of these analyses are shown in Table B-5 in Appendix B. The average lead concentration for the TSP samples was less than 0.20 ug/$m^3$ lead, well below 1.5 ug/$m^3$, the National Ambient Air Quality Standard (NAAQS) for airborne lead.

### *5.7.2 $PM_{10}$ Air Monitoring*

The $PM_{10}$ monitors were run concurrently with the TSP monitors. All of the $PM_{10}$ samples were sent to Environmetrics and were analyzed for total suspended particulate. The results of these analyses are shown in Table B-6 in Appendix B.

The average result was 39.6 ug/$m^3$, well below the NAAQS of 150 ug/$m^3$ for breathable dust emissions. Only one sample, $PM_{10}$-1-001, exceeded the NAAQ value of 150 ug/$m^3$ with a result of 174 ug/$m^3$. This sample was collected before construction activities when dust suppression measures had yet to be implemented. After construction activities began, no result greater than 107 ug/$m^3$ was obtained. The results of the $PM_{10}$ analyses can be seen in Table B-7.

## 5.8 Low-Volume Air Monitoring

The primary purpose of low-volume air monitoring was to ensure the safety of on-site personnel, and to ensure that the proper level of Personal Protective Equipment (PPE) was being worn. Two forms of low-volume air monitoring were used at this site: Personal Air Monitors, and Random Air Monitors.

### *5.8.1 Personal Air Monitoring*

Personal air monitors were worn by ENTACT's field team during removal, handling and placement of all lead-impacted material during the RA, from the beginning of excavation activities until the final placement of the random fill on the pile. Three personal air monitors were used so that at least one monitor was present for each major activity performed that day. The flow rates of the low-volume pumps were measured before and after use. The two flow rates were then averaged, and this average was used to determine the volume of air that had passed through the filter cassette. All cassettes were sent to Environmetrics and were analyzed for total lead, cadmium, and arsenic using NIOSH Method 7300. The results are summarized in Table B-7.

Throughout the course of personal air monitoring, ENTACT maintained Level C PPE for all Exclusion Zone personnel. The ENTACT action level for lead on personal air monitors was 30 $\mu g/m^3$. This level was exceeded one time during the course of the project, when a level of 33.8 $\mu g/m^3$ was reached. When the action level was exceeded, ENTACT's corporate health and safety director was contacted, and adjustments were made to ensure a safe working environment for all field personnel. The eight-hour Personal Exposure Limit (PEL) of 50 $\mu g/m^3$ was never exceeded during the course of personal air monitoring.

### *5.8.2 Random Air Monitoring*

Random air monitoring (RAM) was conducted using a MIE monitor. RAM measured the average dust concentration in the work areas. The RAM provides instantaneous, real-time data about dust concentrations, whereas the other air monitoring methods must rely on off-site analysis.

Two RAM meters were used in this project. One unit was placed on Air Monitoring Station #3, near the soil screening operation, and the other was placed on a fence near the Taracorp Pile haul road, to collect data during pile shaping and material hauling operations. This provided an appropriate representation of the ambient dust concentrations on the site. If the daily time-weighted average (TWA) dust concentration exceeded the 0.150 $mg/m^3$ criteria, the corresponding high volume air monitor filters were automatically submitted for laboratory analysis. Additionally, if any instantaneous ambient dust concentration was greater than 0.250 $mg/m^3$, the filters were also submitted for that day.

The daily TWA dust concentration ranged from 0.000 $mg/m^3$ to about 0.050 mg/m3, never exceeding 0.150 $mg/m^3$ criteria. As a protective measure, the high volume filters were sent to the lab for analysis on every day of monitoring, even though this was not required based upon the RAM results.

## 5.9 QA/QC Results

The QA/QC program included the collection of data quality samples to verify the effectiveness of sampling methodology used throughout the RA. The Field Sampling and Analysis Plan and the Quality Assurance Project Plan called for collection of field duplicates at a ratio of one per every ten samples collected. Field rinsate blanks were not collected for this project since disposable sampling equipment was used.

The field duplicate samples were split directly from the original investigative confirmatory sample. The samples were identified using the same name as the original sample with a "/FD" extension.

The following table presents a comparison of the field duplicate and original investigative results:

**Table 5-1: Comparison of Investigative and Field Duplicate Results**

| Sample ID | Date | Sample Results (mg/Kg) Original | Duplicate | Relative Percent Difference |
|---|---|---|---|---|
| S-031-1.0/FD | 6/9/99 | 64 | 64 | 0% |
| S-087-1.0/FD | 6/14/99 | 838 | 687 | 19.8% |
| S-111-2.0/FD | 6/22/99 | 159 | 157 | 12.6% |
| S-170-1.0/FD | 7/8/99 | 19 | 21 | 7.5% |
| S-177-1.0/FD | 7/8/99 | nd | nd | 0% |

As can be seen in the attached table, the Relative Percent Difference (RPD) was within acceptable limits for all samples where duplicates were analyzed.

The analytical results for the soils were reported on a dry weight basis. Based on a review of the laboratory data by the QC Chemist, the data conforms to the applicable methods and QC criteria and are considered to be valid and acceptable for use.

# Section 6

# 6.0 GEOTECHNICAL QA/QC

## 6.1 Introduction

As required, detailed geotechnical testing was performed as part of the geotechnical QA/QC program for the RA. Geotechnical testing was conducted to ensure that all of the geotechnical requirements were being met. Complete geotechnical test reports are contained in Appendix C.

## 6.2 Geotechnical Testing

The USACE specifications required specific material classifications for fill material used as part of the RA. Midwest Testing of Bridgeton, Missouri was used to provide materials classification services for this project. The following materials were classified by Midwest Testing.

### *6.2.1 Site Backfill*

Backfill for the site on areas other than the landfill cover system was to be classified, according to Section 02210 of the USACE Specifications, using test method ASTM D 2487, as GW, GP, GC, GM, SW, SC, SM, CL, CH, or ML. The screened residential fill material used as the primary source of backfill for the site, was classified as lean clay, CL. The top six inches of fill used across most of the site was classified as gravel with fine material, GM.

### *6.2.2 Random Fill for Cap System*

The random fill layer on the landfill cover system was the layer of soil immediately beneath the Geosynthetic Clay Liner, the first layer of geosynthetic material. The same material as was used for the site backfill discussed above, the screened residential material, was used for the random fill layer of the pile, classified as a lean clay, CL. This is included in the types of acceptable material included in Section 02211 of the USACE Specifications.

### *6.2.3 Protective Layer for Liner Materials*

A twelve-inch layer of sand was installed over the liner materials in order to protect them from battery casings, slag, and other contaminated materials. The sand material used was classified by Midwest Testing as silty sand, SM.

### *6.2.4 Select Fill for Landfill Cover*

The select fill material consists of an 18-inch layer that was applied directly onto the geocomposite drainage layer, the uppermost geosynthetic layer. Section 02223 of the USACE Specifications indicated that acceptable material types included silty sand (SM or SC-SM), clayey sand (SC), or lean clay (CL) according to ASTM D 2487. The material used was classified as lean clay, CL.

## 6.3 Compaction Testing

Another component of the geotechnical QA/QC program was to ensure that all areas of the site were properly compacted. Compaction was required on the landfill to protect the integrity of the cover system, and on the remaining site area, where excessive settling in any one area could affect drainage or have other undesirable effects.

As discussed in Section 4.9, the fill areas of the site were carefully compacted according to the parameters set forth in Section 02210 of the USACE Specifications. In order to confirm that the compacted material had reached the required density, a modified proctor curve was established for the screened residential fill material using ASTM D 1557. Using this curve, densities of compacted material were then determined in the field using ASTM D 2922, Density of Soil and Soil-Aggregate in Place by Nuclear Methods.

A representative from Midwest Testing came to the site on July 13, 1999 to conduct nuclear density testing. Four tests were performed in different areas of the site, in Grids 9, 44, 80, and 177. The results of the compaction tests are presented in the table below.

**Table 6-1: Compaction Testing Data**

| Test Number | Grid | Depth Blow Subgrade, ft. | Dry Density | % Compaction |
|---|---|---|---|---|
| 1 | 44 | 0 | 113.0 | 106.4 |
| 2 | 80 | 0 | 106.8 | 100.6 |
| 3 | 177 | 0 | 95.8 | 90.2 |
| 4 | 9 | 0 | 105.0 | 98.9 |

As the table shows, all compaction tests yielded results of greater than 90% maximum compaction.

# Section seven

Section 7

# 7.0 GEOSYNTHETIC QA/QC

## 7.1 Introduction

The geosynthetic application required close observation and a regimented protocol of QA/QC to ensure that it was properly carried out. The QA/QC program for the geosynthetic application was essentially three stage: pre-construction materials conformance, construction observation and inspection, and post-production materials testing.

## 7.2 Materials Conformance

Certain pre-construction testing was required to determine the suitability of the various geosynthetic materials. All conformance tests, as well as all other geosynthetic analytical testing, was performed by HTS, Inc. of Houston, Texas.

### *7.2.1 Geotextile*

The following table summarizes the conformance testing conducted on the geotextile:

**Table 7-1: Geotextile Conformance Testing**

| Property | Units | Test Method | Target Value | Actual Value |
|---|---|---|---|---|
| Apparent Opening Size | (U.S.sieve) | ASTM D 4751 | (variable) | 100 |
| Permittivity | sec-1 | ASTM D 4491 | 1.00 | 1.66 |
| Puncture | lbs | ASTM D 4833 | 80 | 123 |
| Grab Tensile | lbs | ASTM D 4632 | 180 | 209 |
| Trapezoidal Tear | lbs | ASTM D 4533 | 75 | 87 |
| Burst Strength | psi | ASTM D 3786 | 200 | 349 |

As the table shows, all conformance tests yielded passing results.

### *7.2.2 Geosynthetic Clay Liner*

On-site conformance testing was conducted on the geosynthetic clay liner (GCL) as specified in Part 3.1 of Section 02442 of the USACE Specifications. This section called for the contractor to analyze a sample of GCL for bentonite mass per unit area. HTS, Inc. performed this test and the results are as follows:

**Table 7-2: GCL Conformance Testing**

| Specimen # | Mass per Unit Area (lb/ft2) |
|---|---|
| 1 | 1.34 |
| 2 | 1.32 |
| 3 | 1.32 |
| 4 | 1.33 |
| 5 | 1.29 |
| Average | 1.32 |

As table 7-2 shows, all GCL conformance testing passed the minimum average roll value requirements of 0.95 lbs./$ft^2$.

### *7.2.3 Geomembrane*

No on-site conformance testing was required for the geomembrane.

### *7.2.4 Geocomposite Drainage Layer*

No on-site conformance testing was required for the geocomposite drainage layer.

### *7.2.5 Interface Friction Testing*

Interface friction testing for the cap geosynthetic materials and surrounding soils was conducted as described in Part 2.2.1 of Section 02271 of the USACE Specifications. An additional interface friction test was conducted, select fill over geocomposite drainage layer, to determine if a geogrid was necessary in the cap design.

The following interfaces were tested against one another:

- GCL over random fill soil
- Geomembrane over GCL
- Geocomposite Drainage Layer over Geomembrane
- Geogrid over Geocomposite Drainage Layer
- Select fill over Geogrid
- Select fill over Geocomposite Drainage Layer

Results for the interface friction testing can be found in the table below:

**Table 7-3: Interface Friction Test Results**

| Interface | Peak Angle (degrees) |
|---|---|
| Geomembrane over GCL | 40.0 |
| Geocomposite over Geomembrane | 30.0 |
| Geogrid over Geocomposite | 20.9 |
| Select Fill over Geogrid | 35.5 |
| Select Fill over Geocomposite | 31.6 |

According to the specifications, all of the peak angles had to be at least 16.7 degrees. As the above table shows, all interfaces met the requirement. Because the Select Fill over Geocomposite interface met the requirement, the geogrid layer was deemed to be unnecessary, and it was eliminated from the design. This design change was approved by USEPA and USACE.

## 7.3 Construction Inspection

Supplemental to quantitative testing, qualitative oversight and construction inspection was conducted on a daily basis during all phases of geosynthetics installation. Construction inspection included observing the appearance of geosynthetic materials, widths of material panel overlap, seaming technique on geomembrane, and placement of materials. Any concerns raised by the ENTACT QA/QC and Project Management team were directed to and answered by Robert Brewster, the Senior Field Superintendent for Environmental Specialties International.

## 7.4 Materials Testing

During the course of construction, destructive seam tests were conducted. One test was conducted for every 750 linear feet of seam. The protocol outlined in Part 3.3.3.2 of Section 02271 of the USACE Specifications was followed for the destructive seam testing.

A section of material at least 12 inches wide by 42 inches long (the long side parallel to the seam) was cut from the liner and divided into three sections. One section was tested in the field by ESI, one section was sent to HTS in Houston for independent analysis, and the last section was given to the USACE Contracting Officer. The holes from which the samples were removed were repaired with patches and sealed using extrusion welding.

The following table gives the results for the destructive seam tests. Liner destructive samples (LDS) were taken from the bottom liner, while cap destructive samples (CDS) samples were taken from the cap.

**Table 7-4: Destructive Seam Test Results**

| | Peel Results, (lb/in) | | | | Peel Results, (lb/in) | | |
|---|---|---|---|---|---|---|---|
| Sample | Weld A | Weld B | Shear Result (lb/in) | Sample | Weld A | Weld B | Shear Result (lb/in) |
| LDS-1 | 135 | n/a | 176 | CDS-8 | 89 | 90 | 93 |
| LDS-2 | 152 | n/a | 187 | CDS-9 | 85 | 78 | 92 |
| LDS-3 | 145 | n/a | 180 | CDS-10 | 105 | 101 | 113 |
| LDS-4 | 149 | n/a | 185 | CDS-11 | 99 | 101 | 115 |
| CDS-1 | 94 | 92 | 104 | CDS-12 | 104 | 105 | 117 |
| CDS-2 | 96 | 95 | 102 | CDS-13 | 103 | 105 | 117 |
| CDS-3 | 97 | 97 | 104 | CDS-14 | 104 | 98 | 116 |
| CDS-4 | 94 | 92 | 91 | CDS-15 | 89 | 87 | 98 |
| CDS-5 | 95 | 95 | 98 | CDS-16 | 91 | 83 | 96 |
| CDS-6 | 91 | 92 | 95 | CDS-17 | 96 | 93 | 102 |
| CDS-7 | 95 | 91 | 101 | CDS-18 | 97 | 86 | 103 |

The minimum peel strength was 30 lbs/in for the Cap Destructive Samples (CDS), and 45 for the Liner Destructive Samples (LDS). The minimum shear strength was 40 for the cap, and 90 for the bottom liner. As the data shows, all samples met the requirements.

# Section eight

Section 8

# 8.0 REPORTS, RECORD KEEPING, AND SITE SECURITY

## 8.1 Reporting

Monthly reports for this project were compiled and submitted to the USEPA by Mr. Jeff Leed, the Group's Project Coordinator. These reports detailed the progress made in the previous month, progress made on the project as a whole, and anticipated activities for the coming month. Mr. Leed worked closely with ENTACT in preparing the reports. In addition, both Mr. Leed and the ENTACT project management team participated in weekly conference calls with the USACE and the USEPA.

## 8.2 Records

Detailed record keeping and storage was conducted throughout the RA in accordance to the approved RA Workplan. All QA/QC and project administration records generated by the RA were kept either on the site in the office trailer, or in ENTACT's main Granite City office. The office trailer was occupied around the clock by either ENTACT personnel or by a security officer. Records which were kept at the main office in Granite City were kept in locked, fire-proof file cabinets.

Upon completion of the project, all records were transferred to ENTACT's office in Wood Dale, Illinois, where they were archived and prepared for permanent storage.

## 8.3 Site Security

ENTACT hired Initial Security Services of Granite City to provide site security for all times when ENTACT personnel were not on site. Security personnel were on site from 6:00 p.m. to 6:00 a.m. on weekdays, and around the clock from 6:00 p.m. on Fridays to 6:00 a.m. on Mondays.

ENTACT

# Section nine

# 9.0 HEALTH AND SAFETY

ENTACT carefully followed the Health and Safety Plan (HASP) throughout the course of the project. Strict guidelines were implemented in order to ensure a safe and healthy working environment for all field personnel.

## 9.1 Safety Meetings

At the beginning of the project, a safety orientation was conducted by ENTACT's Corporate Health and Safety Director, Mr. Don Self. During this session, which was attended by the entire field crew, a wide range of general construction safety issues was discussed, as well as issues specific to the NL/Taracorp Site. Field associates were also given the opportunity to voice their questions and concerns about health and safety topics. At the beginning of the project, the field associates were fit-tested for half-face respirators and had blood drawn for blood-lead concentration analysis in adherence to the ENTACT corporate policy.

A morning safety meeting was conducted each day before work began. Each day, a different safety topic was discussed. Associates had the opportunity to voice any health and safety concerns at this time as well.

## 9.2 Personal Protective Equipment

For the majority of this project, field associates wore Level "C" Personal Protective Equipment (PPE). This consisted of cloth coveralls, hardhat, safety glasses, cotton knit gloves, steel toe boots, rubber overboots, and a half-face respirator with dust cartridges. After the random fill had been put on the pile, PPE was downgraded to Level "D." Associates wore all of the items in Level "C," with the exception of the half face respirator, after the PPE was downgraded to Level "D."

## 9.3 Decontamination

A comprehensive personnel decontamination area was established adjacent to the support zone. The decontamination facility included pallets, a boot wash, boot storage racks, a pressure hose, chairs, and containers both for the disposal of used disposable PPE, and for storing coveralls and gloves before being washed. All laundering of re-usable PPE was done on-site in a washer/dryer unit located inside of the decontamination trailer. The decontamination trailer also included sinks and showers for personnel to wash before leaving work.

INTACT

# Section ten

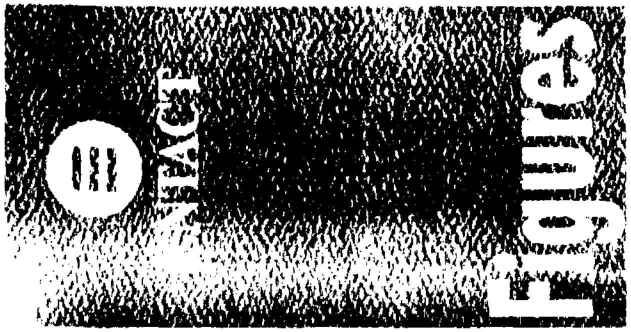
# 10.0 CERTIFICATION

"To the best of my knowledge, after thorough investigation, I certify that the information contained in or accompanying this submission is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

Mark Waxali. P.E.
Professional Engineer
ENTACT, Inc.

Jeffrey A. Reed
Project Coordinator
NL/Taracorp Superfund Site Group

## Figures



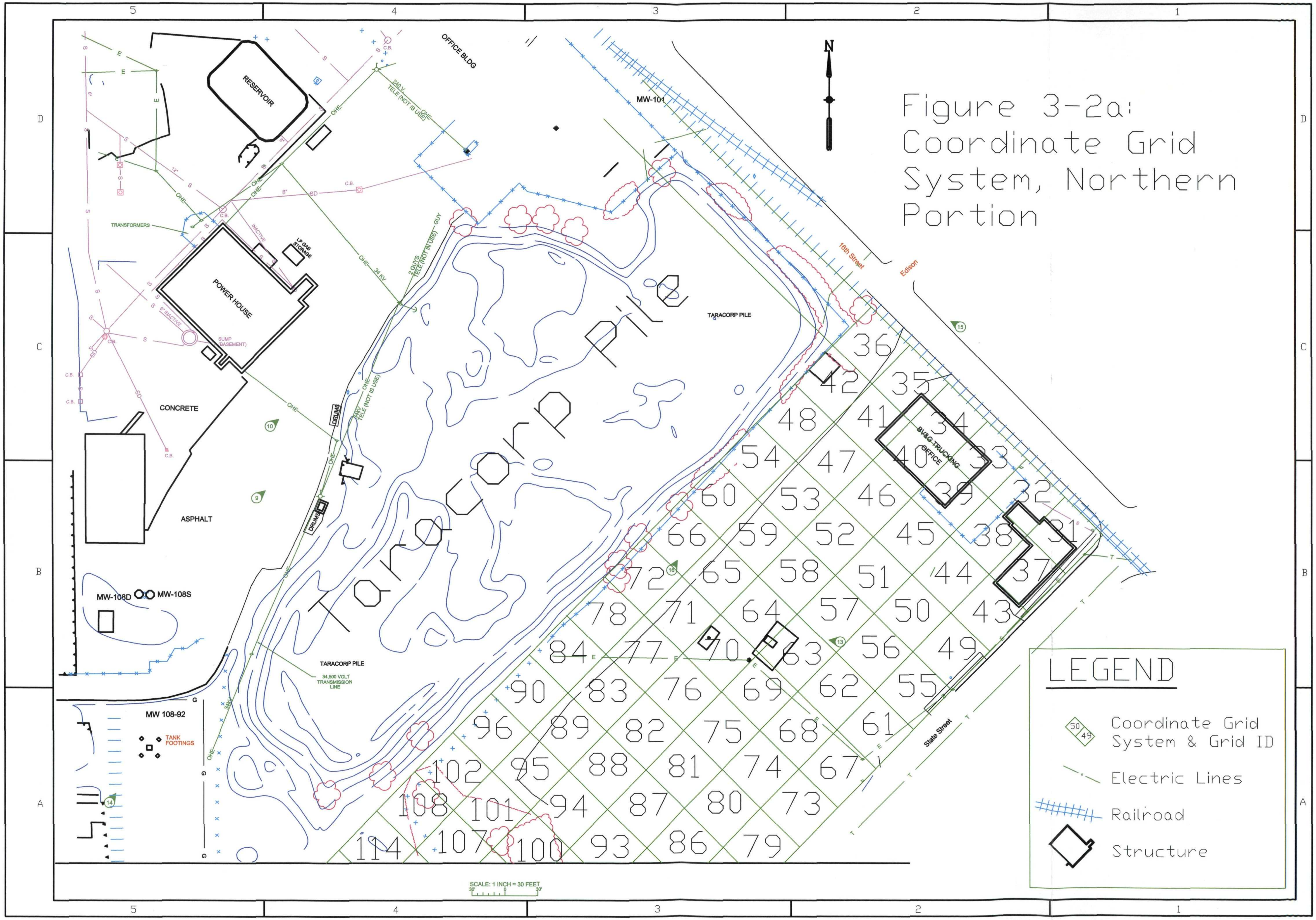
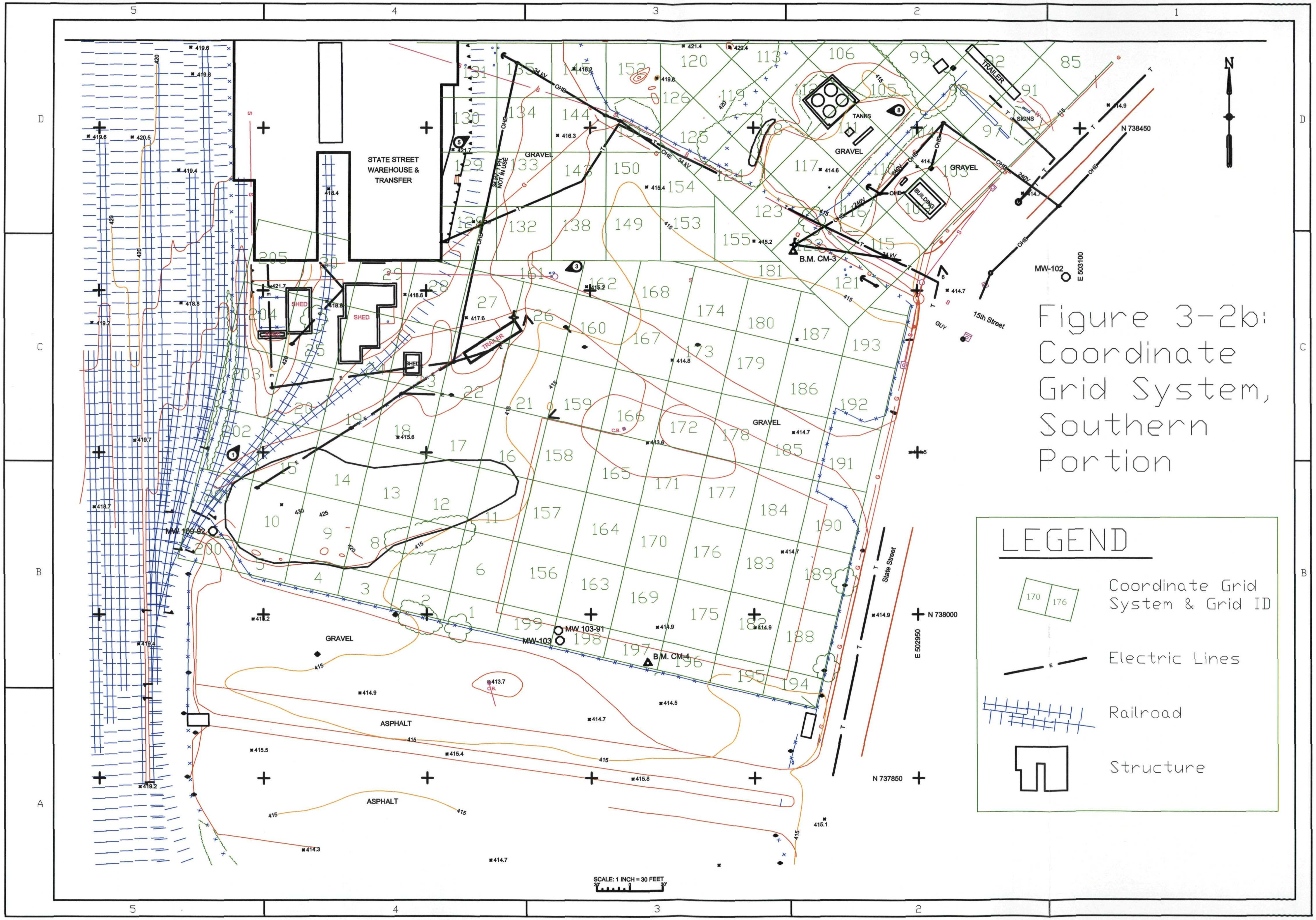



Figure 3-2a: Coordinate Grid System, Northern Portion




# Figure 3-2b: Coordinate Grid System, Southern Portion

## LEGEND

Coordinate Grid System & Grid ID

Electric Lines

Railroad

Structure

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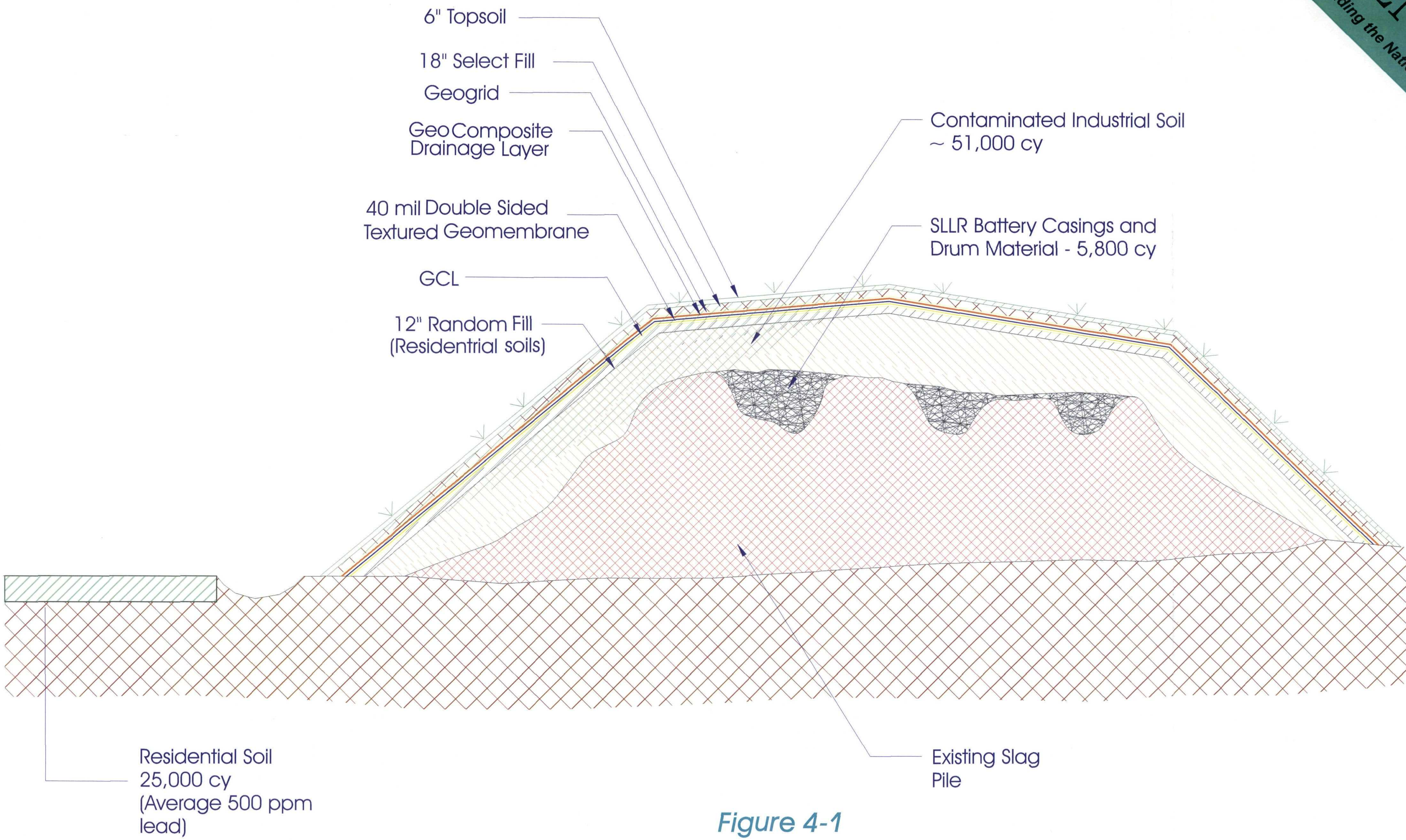


**Figure 4-1**
*Capping Schematic**
*NL/Taracorp Superfund Site*
*Granite City, Illinois*

*Not to Scale

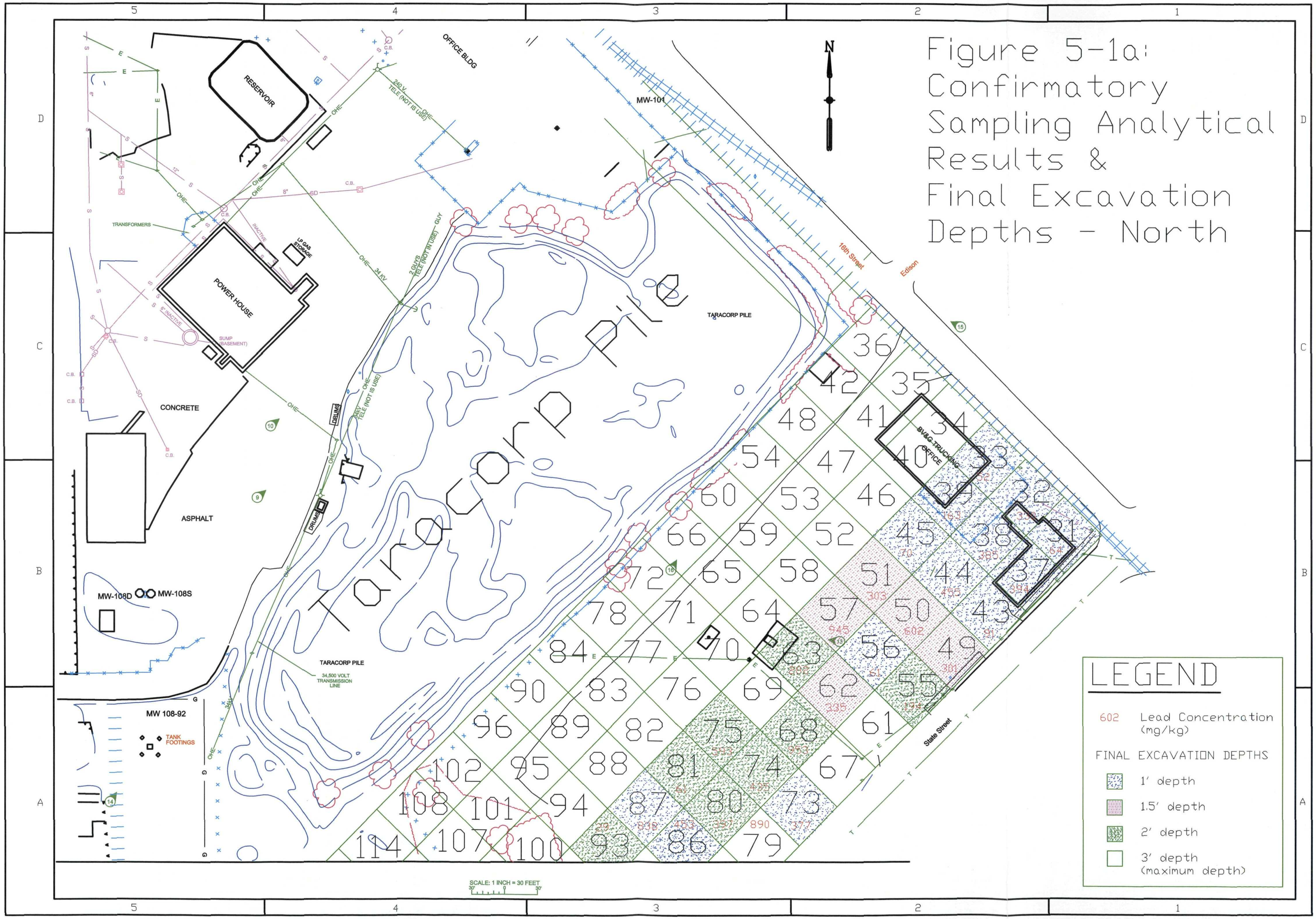


Figure 5-1a: Confirmatory Sampling Analytical Results & Final Excavation Depths - North

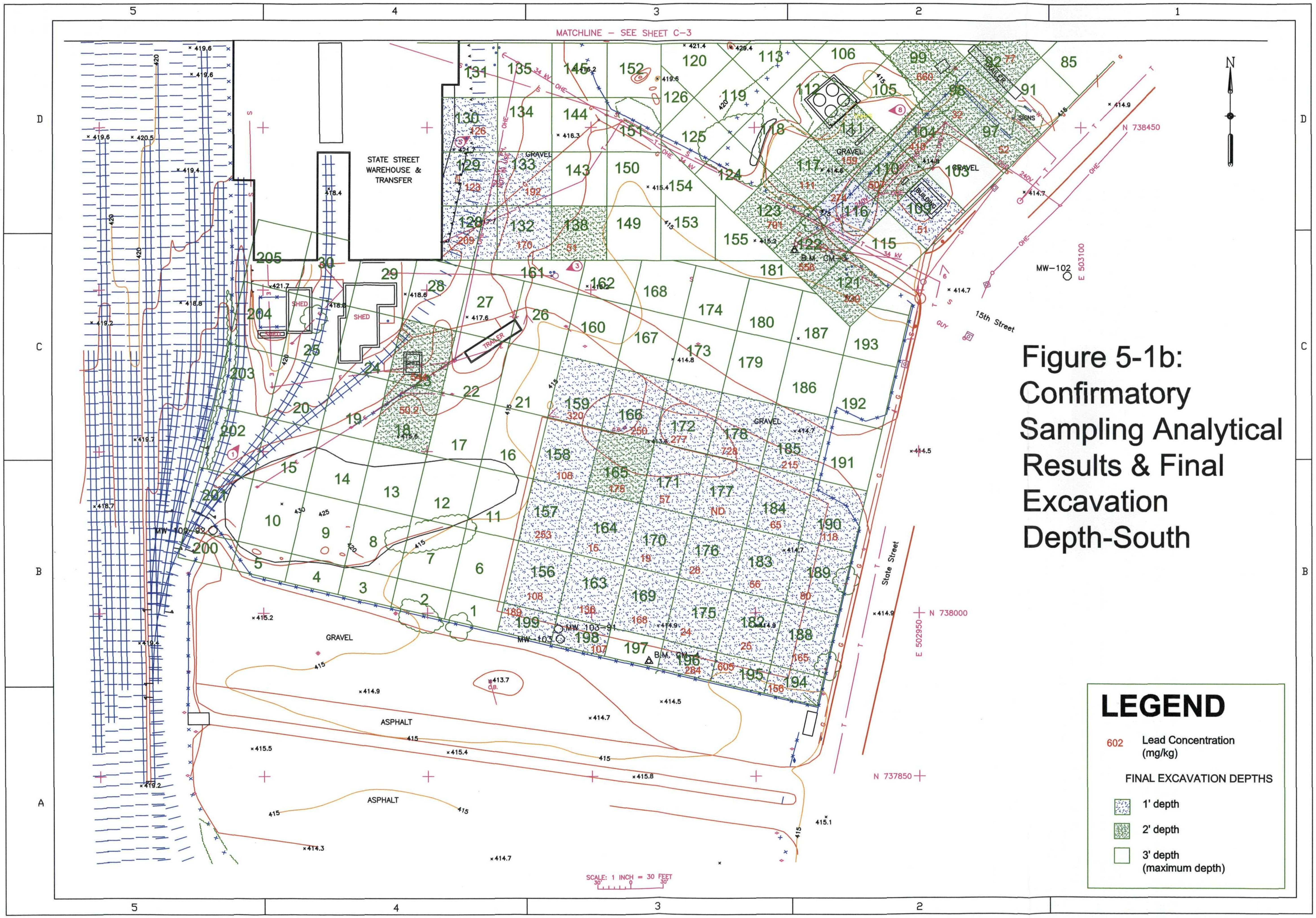


Figure 5-1b: Confirmatory Sampling Analytical Results & Final Excavation Depth-South

# APPENDIX A

# AS-BUILT TECHNICAL DRAWINGS

# Appendix A-1

## Liner Final Grading Plan – Area A

# SDMS US EPA Region V

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# Appendix A-2

## Liner Final Grading Plan – Area B

# Appendix A-3

# Final Cap Elevation – Area A

# Appendix A-4

## Final Cap Elevation – Area B

ENTACT

# Appendix B

Appendix B

# APPENDIX B

# ANALYTICAL RESULTS

# Appendix B-1

## Site Specific Soil Standards

**Table B-1**
**Site-Specific Soil Standard [1] Results (mg/Kg)**
**NL/Taracorp Superfund Site**
**Granite City, Illinois**

| Sample ID [2] | Date Collected | Total Lead (mg/Kg) | Sample ID | Date Collected | Total Lead (mg/Kg) |
|---|---|---|---|---|---|
| SSS-001 [3] | 4/12/99 | 3,030 | SSS-008A | 4/23/99 | 250 |
| SSS-002 [3] | 4/12/99 | 5,140 | SSS-008B | 4/23/99 | 241 |
| SSS-003 [3] | 4/12/99 | 7,200 | SSS-008C | 4/23/99 | 246 |
| SSS-004 [3] | 4/12/99 | 3,320 | SSS-008D | 4/23/99 | 257 |
| SSS-005 [3] | 4/12/99 | 956 | SSS-009A | 4/23/99 | 872 |
| SSS-006 [3] | 4/13/99 | 42 | SSS-009B | 4/23/99 | 798 |
| SSS-007 [3] | 4/13/99 | 183 | SSS-009C | 4/23/99 | 865 |
| SSS-001A | 4/12/99 | 2,780 | SSS-009D | 4/23/99 | 869 |
| SSS-001B | 4/12/99 | 2,920 | SSS-010A | 4/23/99 | 219 |
| SSS-001C | 4/12/99 | 2,730 | SSS-010B | 4/23/99 | 215 |
| SSS-001D | 4/12/99 | 2,940 | SSS-010C | 4/23/99 | 210 |
| SSS-002A | 4/12/99 | 2,860 | SSS-010D | 4/23/99 | 209 |
| SSS-002B | 4/12/99 | 3,240 | SSS-011A | 4/23/99 | 28,600 |
| SSS-002C | 4/12/99 | 3,280 | SSS-011B | 4/23/99 | 28,300 |
| SSS-002D | 4/12/99 | 2,900 | SSS-011C | 4/23/99 | 29,300 |
| SSS-003A | 4/12/99 | 5,490 | SSS-011D | 4/23/99 | 29,600 |
| SSS-003B | 4/12/99 | 5,640 | SSS-012A | 4/30/99 | 65.0 |
| SSS-003C | 4/12/99 | 5,960 | SSS-012B | 4/30/99 | 66.0 |
| SSS-003D | 4/12/99 | 5,280 | SSS-012C | 4/30/99 | 60.0 |
| SSS-004A | 4/12/99 | 2,920 | SSS-012D | 4/30/99 | 65.0 |
| SSS-004B | 4/12/99 | 2,720 | SSS-013A | 4/30/99 | 19.0 |
| SSS-004C | 4/12/99 | 2,880 | SSS-013B | 4/30/99 | 20.0 |
| SSS-004D | 4/12/99 | 3,010 | SSS-013C | 4/30/99 | 18.0 |
| SSS-005A | 4/12/99 | 880 | SSS-013D | 4/30/99 | 18.0 |
| SSS-005B | 4/12/99 | 855 | SSS-014A | 4/30/99 | 33.0 |
| SSS-005C | 4/12/99 | 800 | SSS-014B | 4/30/99 | 36.0 |
| SSS-005D | 4/12/99 | 740 | SSS-014C | 4/30/99 | 34.0 |
| SSS-006A | 4/13/99 | 37.0 | SSS-014D | 4/30/99 | 32.0 |
| SSS-006B | 4/13/99 | 38.0 | SSS-015A | 4/30/99 | 127 |
| SSS-006C | 4/13/99 | 34.0 | SSS-015B | 4/30/99 | 141 |
| SSS-006D | 4/13/99 | 35.0 | SSS-015C | 4/30/99 | 120 |
| SSS-007A | 4/13/99 | 98.0 | SSS-015D | 4/30/99 | 133 |
| SSS-007B | 4/13/99 | 106 | | | |
| SSS-007C | 4/13/99 | 106 | | | |
| SSS-007D | 4/13/99 | 95.0 | | | |

# Appendix B-2

# Confirmatory Soil Sample Data

**Table B-2**
**Confirmatory Soil Sample Results**
**NL/Taracorp Superfund Site**
**Granite City, Illinois**

| Sample ID | Date Collected | Total Lead (mg/Kg) | | Sample ID | Date Collected | Total Lead (mg/Kg) |
|---|---|---|---|---|---|---|
| S-039-1.0 | 6/9/99 | 163 | | S-111-2.0 | 6/22/99 | 159 |
| S-038-1.0 | 6/9/99 | 385 | | S-099-2.0 | 6/22/99 | 560 |
| S-037-1.0 | 6/9/99 | 349 | | S-117-2.0 | 6/22/99 | 111 |
| S-032-1.0 | 6/9/99 | 330 | | S-109-1.0 | 6/22/99 | 51 |
| S-031-1.0 | 6/9/99 | 64 | | S-137-1.0 | 6/22/99 | 42 |
| S-045-1.0 | 6/9/99 | 70 | | S-132-2.0 | 6/22/99 | 170 |
| S-044-1.0 | 6/9/99 | 455 | | S-081-2.0 | 6/22/99 | 61 |
| S-043-1.0 | 6/9/99 | 91 | | S-138-2.0 | 6/22/99 | 51 |
| S-062-1.5 | 6/10/99 | 335 | | S-110-1.0 | 6/23/99 | 29 |
| S-057-1.5 | 6/10/99 | 945 | | S-080-2.0 | 6/23/99 | 397 |
| S-050-1.5 | 6/10/99 | 602 | | S-074-2.0 | 6/23/99 | 435 |
| S-049-1.5 | 6/10/99 | 301 | | S-194-1.0 | 6/28/99 | 156 |
| S-051-1.5 | 6/10/99 | 303 | | S-188-1.0 | 6/28/99 | 165 |
| S-069-2.0 | 6/14/99 | 1150 [1] | | S-189-1.0 | 6/28/99 | 80 |
| S-033-1.0 | 6/14/99 | 52 | | S-190-1.0 | 6/28/99 | 118 |
| S-056-1.0 | 6/14/99 | 61 | | S-195-1.0 | 6/28/99 | 605 |
| S-055-2.0 | 6/14/99 | 194 | | S-182-1.0 | 6/28/99 | 25 |
| S-073-1.0 | 6/14/99 | 377 | | S-183-1.0 | 6/28/99 | 56 |
| S-063-2.0 | 6/14/99 | 282 | | S-184-1.0 | 6/28/99 | 65 |
| S-068-2.0 | 6/14/99 | 953 | | S-196-1.0 | 6/28/99 | 284 |
| S-079 | 6/14/99 | 890 | | S-163-1.0 | 6/29/99 | 136 |
| S-086-1.0 | 6/14/99 | 453 | | S-198-1.0 | 6/29/99 | 107 |
| S-087-1.0 | 6/14/99 | 838 | | S-156-1.0 | 6/29/99 | 108 |
| S-028-2.0 | 6/15/99 | 17 | | S-199-1.0 | 6/29/99 | 189 |
| S-023-2.0 | 6/15/99 | 544 | | S-169-1.0 | 6/29/99 | 168 |
| S-028-2.0 | 6/17/99 | 1668 [1] | | S-157-1.0 | 6/29/99 | 253 |
| S-018-2.0 | 6/17/99 | 50.2 | | S-175-1.0 | 6/29/99 | 24 |
| S-023-2.0 | 6/17/99 | 348 | | S-121-2.0 | 7/7/99 | 330 |
| S-091-2.0-A | 6/19/99 | 538 | | S-122-2.0 | 7/7/99 | 556 |
| S-110-2.0 | 6/19/99 | 507 | | S-123-2.0 | 7/7/99 | 791 |
| S-104-2.0 | 6/19/99 | 410 | | S-001-1.0 | 7/8/99 | 227 |
| S-098-2.0 | 6/19/99 | 32 | | S-158-1.0 | 7/8/99 | 108 |
| S-097-2.0 | 6/19/99 | 52 | | S-159-1.0 | 7/8/99 | 320 |
| S-093-2.0 | 6/19/99 | 29 | | S-164-1.0 | 7/8/99 | 15 |
| S-092-2.0 | 6/19/99 | 77 | | S-170-1.0 | 7/8/99 | 19 |
| S-091-2.0-B | 6/19/99 | 261 | | S-176-1.0 | 7/8/99 | 28 |
| S-075-2.0 | 6/19/99 | 593 | | S-177-1.0 | 7/8/99 | U |
| S-091-2.0/ED | 6/19/99 | 1780 [1] | | S-178-1.0 | 7/8/99 | 728 |
| S-133-1.0 | 6/21/99 | 192 | | S-165-1.0 | 7/8/99 | 1690 [1] |
| S-130-1.0 | 6/21/99 | 126 | | S-166-1.0 | 7/8/99 | 1070 [1] |
| S-128-1.0 | 6/21/99 | 209 | | S-165-2.0 | 7/12/99 | 175 |
| S-127-1.0 | 6/21/99 | 2110 [1] | | S-166-2.0 | 7/12/99 | 250 |
| S-134-1.0 | 6/21/99 | 6770 [1] | | S-171-1.0 | 7/12/99 | 57 |
| S-129-1.0 | 6/21/99 | 123 | | S-172-1.0 | 7/12/99 | 277 |
| S-116-2.0 | 6/22/99 | 274 | | S-185-1.0 | 7/12/99 | 215 |

*[1]: Verification sample failed. Excavation continued until XRF instrument indicated levels were below the performance standard of 1,000 mg/Kg or to themaximum depth of 3 feet.*

# Appendix B-3

## Residential Soil Sample Data

**Table B-3**
**Residential Backfill Sample Results**
**NL/Taracorp Superfund Site**
**Granite City, Illinois**

| Sample ID | Date Collected | Total Lead (mg/Kg) | Sample ID | Date Collected | Total Lead (mg/Kg) |
|---|---|---|---|---|---|
| RF-001 | 3/24/99 | 385 | RF-049 | | 351 |
| RF-002 | 3/26/99 | 528 | RF-050 | 6/14/99 | 449 |
| RF-003 | 3/26/99 | 467 | RF-051 | 6/14/99 | 419 |
| RF-004 | 4/28/99 | 431 | RF-052 | 6/14/99 | 371 |
| RF-005 | 5/3/99 | 441 | RF-053 | 6/4/99 | 393 |
| RF-006 | 5/7/99 | 340 | RF-054 | 6/15/99 | 478 |
| RF-007 | 5/10/99 | 384 | RF-055 | 6/15/99 | 401 |
| RF-008 | 5/24/99 | 527 | RF-056 | 6/15/99 | 388 |
| RF-009 | 5/24/99 | 655 | RF-057 | 6/15/99 | 396 |
| RF-010 | 5/24/99 | 451 | RF-058 | 6/15/99 | 506 |
| RF-011 | 5/26/99 | 426 | RF-059 | 6/16/99 | 511 |
| RF-012 | 5/26/99 | 442 | RF-060 | 6/16/99 | 380 |
| RF-013 | 5/26/99 | 384 | RF-061 | 6/16/99 | 337 |
| RF-014 | 5/26/99 | 409 | RF-062 | 6/16/99 | 386 |
| RF-015 | 5/24/99 | 456 | RF-063 | 6/16/99 | 374 |
| RF-016 | 5/24/99 | 550 | RF-064 | 6/16/99 | 577 |
| RF-017 | 5/25/99 | 584 | RF-065 | 6/18/99 | 392 |
| RF-018 | 5/25/99 | 500 | RF-066 | 6/18/99 | 396 |
| RF-019 | 5/25/99 | 492 | RF-067 | 6/18/99 | 520 |
| RF-020 | 5/26/99 | 494 | RF-068 | 6/18/99 | 467 |
| RF-021 | 5/27/99 | 462 | RF-069 | 6/18/99 | 440 |
| RF-022 | 5/27/99 | 322 | RF-070 | 6/18/99 | 345 |
| RF-023 | 5/28/99 | 348 | RF-071 | 6/23/99 | 354 |
| RF-024 | 6/2/99 | 360 | RF-072 | 6/23/99 | 378 |
| RF-025 | 6/2/99 | 438 | RF-073 | 6/23/99 | 356 |
| RF-026 | 6/3/99 | 335 | RF-074 | 6/23/99 | 402 |
| RF-027 | 6/3/99 | 404 | RF-075 | 6/23/99 | 370 |
| RF-028 | 6/4/99 | 377 | RF-076 | 6/23/99 | 375 |
| RF-029 | 6/4/99 | 329 | RF-077 | 6/23/99 | 368 |
| RF-030 | 6/7/99 | 370 | RF-078 | 6/23/99 | 386 |
| RF-031 | 6/7/99 | 371 | RF-079 | 6/23/99 | 385 |
| RF-032 | 6/7/99 | 371 | RF-080 | 7/1/99 | 535 |
| RF-033 | 6/7/99 | 409 | RF-081 | 7/1/99 | 567 |
| RF-034 | 6/7/99 | 403 | RF-082 | 7/1/99 | 386 |
| RF-035 | 6/8/99 | 318 | RF-083 | 7/1/99 | 407 |
| RF-036 | 6/8/99 | 372 | RF-084 | 7/1/99 | 419 |
| RF-037 | 6/9/99 | 361 | RF-085 | 7/1/99 | 487 |
| RF-038 | 6/9/99 | 306 | RF-086 | 7/1/99 | 436 |
| RF-039 | 6/9/99 | 338 | RF-087 | 7/1/99 | 451 |
| RF-040 | 6/9/99 | 352 | RF-088 | 7/8/99 | 703 |
| RF-041 | 6/9/99 | 448 | RF-089 | 7/8/99 | 529 |
| RF-042 | 6/9/99 | 484 | RF-090 | 7/8/99 | 492 |
| RF-043 | 6/10/99 | 369 | RF-091 | 7/8/99 | 448 |
| RF-044 | 6/10/99 | 358 | RF-092 | 7/8/99 | 491 |
| RF-045 | 6/10/99 | 376 | RF-093 | 7/8/99 | 598 |
| RF-046 | 6/10/99 | 371 | RF-094 | 7/8/99 | 519 |
| RF-047 | 6/10/99 | 415 | RF-095 | 7/8/99 | 411 |
| RF-048 | 6/10/99 | 415 | | | |
| **Average Residential Fill Concentration:** | | | | | 425.87 |

# Appendix B-4

# UST Confirmatory Soil Sample Data

## Table B-4
## Underground Storage Tank Confirmatory Soil Sample Results
## NL/Taracorp Superfund Site
## Granite City, Illinois

| Sample Location | Sample ID | Date Taken | Analytical Parameter (mg/Kg) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Benzene | Toluene | Ethylbenzene | Xylene | Acenaphthene | acenaphthylene | anthracene | benzo (a) anthracene | benzo (b) fluoroanthene | benzo (k) fluoroanthene |
| 20,000-gallon UST: | | | | | | | | | | | | |
| North Sidewall | UST-1 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| East Sidewall | UST-2 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | 0.021 | 0.016 | 0.010 |
| East Sidewall | UST-3 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| South Sidewall | UST-4 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| West Sidewall | UST-5 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| West Sidewall | UST-6 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| North Floor | UST-7 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| South Floor | UST-8 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| 200-gallon UST: | | | | | | | | | | | | |
| North Sidewall | UST-9 | 7/30/99 | 0.071 | 0.325 | 0.061 | 0.481 | nd | nd | nd | 0.097 | 0.069 | 0.033 |
| East Sidewall | UST-10 | 7/30/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| South Sidewall | UST-11 | 7/30/99 | nd | nd | nd | nd | nd | nd | nd | 0.045 | 0.025 | 0.010 |
| West Sideall | UST-12 | 7/30/99 | nd | nd | nd | 8 | nd | nd | nd | 0.047 | 0.034 | 0.017 |
| Floor | UST-13 | 7/30/99 | nd | nd | nd | nd | nd | nd | 0.077 | 0.206 | 0.120 | 0.060 |

| Sample Location | Sample ID | Date Taken | benzo (a) pyrene | benzo (ghi) perylene | chrysene | dibenzo (a,h) anthracene | flouranthene | fluorene | indeno (1,2,3-cd) pyrene | naphthalene | Phenanthrene | Pyrene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20,000-gallon UST: | | | | | | | | | | | | |
| North Sidewall | UST-1 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| East Sidewall | UST-2 | 4/20/99 | 0.025 | nd | nd | nd | 0.049 | nd | | 0.014 | nd | 0.046 |
| East Sidewall | UST-3 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| South Sidewall | UST-4 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| West Sidewall | UST-5 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| West Sidewall | UST-6 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| North Floor | UST-7 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| South Floor | UST-8 | 4/20/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| 200-gallon UST: | | | | | | | | | | | | |
| North Sidewall | UST-9 | 7/30/99 | 0.089 | 0.081 | 0.075 | nd | 0.140 | nd | 0.055 | 0.037 | 0.086 | 0.198 |
| East Sidewall | UST-10 | 7/30/99 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| South Sidewall | UST-11 | 7/30/99 | 0.037 | nd | nd | nd | 0.079 | nd | 0.021 | nd | nd | 0.080 |
| West Sideall | UST-12 | 7/30/99 | 0.050 | nd | nd | nd | 0.078 | nd | 0.024 | nd | nd | 0.120 |
| Floor | UST-13 | 7/30/99 | 0.165 | 0.130 | 0.018 | 0.010 | 0.385 | nd | 0.088 | 0.036 | 0.288 | 0.398 |

*nd: not detected*

## Appendix B-5

## Imported Backfill Sample Data

**Table B-5**
**Backfill Characterization, Sample: SF-001**
**NL/Taracorp Superfund Site**
**Granite City, Illinois**

| **Metals** | **(mg/kg)** | **Volatile Organics con't,** | **(ug/kg)** |
|---|---|---|---|
| Arsenic | <3.00 | trans-1,3-Dichloropropene | nd |
| Barium | 157 | 4-Methyl-2-pentanone | nd |
| Cadmium | <0.400 | 2-Nitropropane | nd |
| Chromium | 13.2 | Toluene | nd |
| Lead | 20.5 | cis-1,3-Dichloropropene | nd |
| Mercury | <0.100 | Ethyl Methacrylate | nd |
| Selenium | <4.70 | 1,1,2-Trichloroethane | nd |
| Silver | <0.400 | Tetrachloroethene | nd |
| | | 1,3-Dichloropropane | nd |
| **Volatile Organics** | **(ug/kg)** | 2-Hexanone | nd |
| Dichlorofluoromethane | nd | Chlorodibromomethane | nd |
| *Chloromethane* | *nd* | *1,2-Dibromoethane* | *nd* |
| Vinyl chloride | nd | Chlorobenzene | nd |
| Bromomethane | nd | 1,1,1,2-Tetrachloroethane | nd |
| Chloroethane | nd | Ethylbenzene | nd |
| Trichlorofluoromethane | nd | m&p-Xylene | nd |
| 1,1-Dichloroethene | nd | o-Xylene | nd |
| 1,1,2-Tricloro-1,2,2-trifluoroethane | nd | Styrene | nd |
| Acetone | nd | Bromoform | nd |
| Vinyl Acetate | nd | Isopropylbenzene | nd |
| Methyl iodide | nd | 1,1,2,2-Tetrachloroethane | nd |
| Carbon disulfide | nd | Bromobenzene | nd |
| Allyl chloride | nd | tran-1,4-Dichloro-2-butene | nd |
| Acetonitrile | nd | 1,2,3-Trichloropropane | nd |
| Methylene chloride | nd | n-Propylbenzene | nd |
| Acrylonitrile | nd | 2-Chlorotoluene | nd |
| Methyl tert butyl ether | nd | t-Butylbenzene | nd |
| trans-1,2-Dichloroethene | nd | 1,2,4-Trimethylbenzene | nd |
| 1,1-Dichloroethane | nd | sec-Butlybenzene | nd |
| Acrolein | nd | 1,3-Dichlorobenzene | nd |
| cis-1,2-Dichloroethene | nd | p-Isopropyltonuene | nd |
| 2-Butanone (MEK) | nd | 1,4-Dichlorobenzene | nd |
| 2,2-Dichloropropane | nd | 1,2-Dichlorobenzene | nd |
| Proprionitrile | nd | n-Butylbenzene | nd |
| Methacrylonitrile | nd | 1,2-Dibromo-3-chloropropane | nd |
| Bromochloromethane | nd | *1,2,4-Trichlorobenzene* | *nd* |
| Chloroform | nd | Hexachlorobutadiene | nd |
| 1,1,1-Trichloroethane | nd | Naphthalene | nd |
| 1,1-Dichloropropene | nd | 1,2,3-Trichlorobenzene | nd |
| Carbon tetrachloride | nd | 2-Chloroethyl vinyl ether | nd |
| 1,2-Dichloroethane | nd | 1,2-Dichloropropane | nd |
| Benzene | nd | Methyl Methacrylate | nd |
| Isobutyl Alcohol | nd | 1,4-Dioxin | nd |
| Bromodichloromethane | nd | Dibromomethane | nd |

*nd: not detected*

# Appendix B-6

## High Volume Air Monitoring Sample Data
## TSP and PM10

Table B-6
TSP Air Monitoring Results
NL/Taracorp Superfund Site, Granite City, Illinois

| Sample ID | Date | Analyte | Result* | Sample ID | Date | Analyte | Result* |
|---|---|---|---|---|---|---|---|
| TSP-1-001 | 3/29/99 | Total Lead | 0.344 | TSP-3-023 | 4/6/99 | Total Lead | 0.184 |
| TSP-1-001 | 3/29/99 | Particulate Matter | 210 | TSP-3-023 | 4/6/99 | Particulate Matter | 57.9 |
| TSP-3-003 | 3/29/99 | Total Lead | U | TSP-4-024 | 4/6/99 | Total Lead | 1.62 |
| TSP-3-003 | 3/29/99 | Particulate Matter | 72.5 | TSP-4-024 | 4/6/99 | Particulate Matter | 76.1 |
| TSP-4-004 | 3/29/99 | Total Lead | 0.347 | TSP-1-025 | 4/7/99 | Total Lead | 0.183 |
| TSP-4-004 | 3/29/99 | Particulate Matter | 127 | TSP-1-025 | 4/7/99 | Particulate Matter | 199 |
| TSP-1-005 | 3/30/99 | Total Lead | 0.206 | TSP-2-026 | 4/7/99 | Total Lead | 0.097 |
| TSP-1-005 | 3/30/99 | Particulate Matter | 210 | TSP-2-026 | 4/7/99 | Particulate Matter | 102 |
| TSP-3-007 | 3/30/99 | Total Lead | 0.0683 | TSP-3-027 | 4/7/99 | Total Lead | 0.287 |
| TSP-3-007 | 3/30/99 | Particulate Matter | 78.2 | TSP-3-027 | 4/7/99 | Particulate Matter | 94.2 |
| TSP-4-008 | 3/30/99 | Total Lead | 0.159 | TSP-4-028 | 4/7/99 | Total Lead | 1.28 |
| TSP-4-008 | 3/30/99 | Particulate Matter | 81 | TSP-4-028 | 4/7/99 | Particulate Matter | 80.7 |
| TSP-1-009 | 3/31/99 | Total Lead | 0.243 | TSP-1-029 | 4/8/99 | Total Lead | 0.191 |
| TSP-1-009 | 3/31/99 | Particulate Matter | 177 | TSP-1-029 | 4/8/99 | Particulate Matter | 106 |
| TSP-3-011 | 3/31/99 | Total Lead | 0.0539 | TSP-2-030 | 4/8/99 | Total Lead | 0.172 |
| TSP-3-011 | 3/31/99 | Particulate Matter | 37.4 | TSP-2-030 | 4/8/99 | Particulate Matter | 141 |
| TSP-4-012 | 3/31/99 | Total Lead | 0.178 | TSP-3-031 | 4/8/99 | Total Lead | 0.107 |
| TSP-4-012 | 3/31/99 | Particulate Matter | 59.6 | TSP-3-031 | 4/8/99 | Particulate Matter | 48.5 |
| TSP-1-013 | 4/1/99 | Particulate Matter | 141 | TSP-4-032 | 4/8/99 | Total Lead | 1.06 |
| TSP-1-013 | 4/1/99 | Total Lead | 0.135 | TSP-4-032 | 4/8/99 | Particulate Matter | 75.7 |
| TSP-3-015 | 4/1/99 | Particulate Matter | 23 | TSP-1-033 | 4/12/99 | Total Lead | 0.329 |
| TSP-3-015 | 4/1/99 | Total Lead | 0.0463 | TSP-1-033 | 4/12/99 | Particulate Matter | 253 |
| TSP-4-016 | 4/1/99 | Total Lead | 0.222 | TSP-2-034 | 4/12/99 | Total Lead | 0.23 |
| TSP-4-016 | 4/1/99 | Particulate Matter | 53.3 | TSP-2-034 | 4/12/99 | Particulate Matter | 110 |
| TSP-1-017 | 4/5/99 | Total Lead | 0.439 | TSP-3-035 | 4/12/99 | Total Lead | 0.061 |
| TSP-1-017 | 4/5/99 | Particulate Matter | 77.3 | TSP-3-035 | 4/12/99 | Particulate Matter | 30.3 |
| TSP-3-019 | 4/5/99 | Total Lead | 0.037 | TSP-4-036 | 4/12/99 | Total Lead | 0.3 |
| TSP-3-019 | 4/5/99 | Particulate Matter | 25.7 | TSP-4-036 | 4/12/99 | Particulate Matter | 86.5 |
| TSP-4-020 | 4/5/99 | Total Lead | 0.436 | TSP-1-037 | 4/13/99 | Total Lead | 0.199 |
| TSP-4-020 | 4/5/99 | Particulate Matter | 36.7 | TSP-1-037 | 4/13/99 | Particulate Matter | 190 |
| TSP-1-021 | 4/6/99 | Total Lead | 0.191 | TSP-2-038 | 4/13/99 | Total Lead | 0.131 |
| TSP-1-021 | 4/6/99 | Particulate Matter | 168 | TSP-2-038 | 4/13/99 | Particulate Matter | 90.2 |

*Total Lead results reported in ug/m3, Particulate Matter reported in ug/m3

Table B-6
TSP Air Monitoring Results
NL/Taracorp Superfund Site, Granite City, Illinois

| Sample ID | Date | Analyte | Result* | Sample ID | Date | Analyte | Result* |
|---|---|---|---|---|---|---|---|
| TSP-3-039 | 4/13/99 | Total Lead | 0.071 | TSP-1-057 | 4/21/99 | Particulate Matter | 159 |
| TSP-3-039 | 4/13/99 | Particulate Matter | 66.8 | TSP-1-057 | 4/21/99 | Total Lead | 0.078 |
| TSP-4-040 | 4/13/99 | Total Lead | 0.131 | TSP-2-058 | 4/21/99 | Particulate Matter | 170 |
| TSP-4-040 | 4/13/99 | Particulate Matter | 65.6 | TSP-2-058 | 4/21/99 | Total Lead | 0.132 |
| TSP-1-041 | 4/14/99 | Particulate Matter | 45.1 | TSP-3-059 | 4/21/99 | Particulate Matter | 109 |
| TSP-1-041 | 4/14/99 | Total Lead | 0.09 | TSP-3-059 | 4/21/99 | Total Lead | 0.081 |
| TSP-2-042 | 4/14/99 | Particulate Matter | 34.3 | TSP-4-060 | 4/21/99 | Particulate Matter | 115 |
| TSP-2-042 | 4/14/99 | Total Lead | 0.045 | TSP-4-060 | 4/21/99 | Total Lead | 0.609 |
| TSP-3-043 | 4/14/99 | Particulate Matter | 18 | TSP-1-061 | 4/22/99 | Particulate Matter | 126 |
| TSP-3-043 | 4/14/99 | Total Lead | 0.025 | TSP-1-061 | 4/22/99 | Total Lead | 0.167 |
| TSP-4-044 | 4/14/99 | Particulate Matter | 27.1 | TSP-2-062 | 4/22/99 | Particulate Matter | 71.4 |
| TSP-4-044 | 4/14/99 | Total Lead | 0.133 | TSP-2-062 | 4/22/99 | Total Lead | 0.841 |
| TSP-1-045 | 4/15/99 | Total Lead | 0.248 | TSP-3-063 | 4/22/99 | Particulate Matter | 23.2 |
| TSP-1-045 | 4/15/99 | Particulate Matter | 16.6 | TSP-3-063 | 4/22/99 | Total Lead | 0.123 |
| TSP-2-046 | 4/15/99 | Total Lead | 0.028 | TSP-4-064 | 4/22/99 | Particulate Matter | 103 |
| TSP-2-046 | 4/15/99 | Particulate Matter | 12.7 | TSP-4-064 | 4/22/99 | Total Lead | 0.236 |
| TSP-4-048 | 4/15/99 | Particulate Matter | 11.2 | TSP-1-065 | 4/26/99 | Particulate Matter | 96.7 |
| TSP-4-048 | 4/15/99 | Total Lead | 0.177 | TSP-1-065 | 4/26/99 | Total Lead | 0.085 |
| TSP-1-049 | 4/19/99 | Particulate Matter | 291 | TSP-2-066 | 4/26/99 | Particulate Matter | 65 |
| TSP-1-049 | 4/19/99 | Total Lead | 0.238 | TSP-2-066 | 4/26/99 | Total Lead | 0.047 |
| TSP-2-050 | 4/19/99 | Particulate Matter | 149 | TSP-3-067 | 4/26/99 | Particulate Matter | 48.2 |
| TSP-2-050 | 4/19/99 | Total Lead | 0.236 | TSP-3-067 | 4/26/99 | Total Lead | 0.025 |
| TSP-3-051 | 4/19/99 | Particulate Matter | 108 | TSP-4-068 | 4/26/99 | Particulate Matter | 42 |
| TSP-3-051 | 4/19/99 | Total Lead | 0.144 | TSP-4-068 | 4/26/99 | Total Lead | 0.082 |
| TSP-4-052 | 4/19/99 | Particulate Matter | 97.4 | TSP-2-070 | 4/27/99 | Particulate Matter | 38.4 |
| TSP-4-052 | 4/19/99 | Total Lead | 0.741 | TSP-2-070 | 4/27/99 | Total Lead | 0.049 |
| TSP-1-053 | 4/20/99 | Particulate Matter | 133 | TSP-3-071 | 4/27/99 | Particulate Matter | 25.8 |
| TSP-1-053 | 4/20/99 | Total Lead | 0.134 | TSP-3-071 | 4/27/99 | Total Lead | 0.04 |
| TSP-2-054 | 4/20/99 | Particulate Matter | 92.8 | TSP-4-072 | 4/27/99 | Particulate Matter | 34.1 |
| TSP-2-054 | 4/20/99 | Total Lead | 0.113 | TSP-4-072 | 4/27/99 | Total Lead | 0.097 |
| TSP-3-055 | 4/20/99 | Particulate Matter | 25.4 | TSP-3-075 | 4/28/99 | Particulate Matter | 16 |
| TSP-3-055 | 4/20/99 | Total Lead | 0.057 | TSP-3-075 | 4/28/99 | Total Lead | 0.062 |
| TSP-4-056 | 4/20/99 | Particulate Matter | 89.7 | TSP-4-076 | 4/28/99 | Particulate Matter | 65.8 |
| TSP-4-056 | 4/20/99 | Total Lead | 0.337 | TSP-4-076 | 4/28/99 | Total Lead | 0.083 |

*Total Lead results reported in ug/m3, Particulate Matter reported in ug/m3

Table B-6
TSP Air Monitoring Results
NL/Taracorp Superfund Site, Granite City, Illinois

| Sample ID | Date | Analyte | Result* | Sample ID | Date | Analyte | Result* |
|---|---|---|---|---|---|---|---|
| TSP-1-077 | 5/3/99 | Particulate Matter | 331 | TSP-3-095 | 5/11/99 | Particulate Matter | 31.2 |
| TSP-1-077 | 5/3/99 | Total Lead | 0.131 | TSP-3-095 | 5/11/99 | Total Lead | U |
| TSP-2-078 | 5/3/99 | Particulate Matter | 131 | TSP-4-096 | 5/11/99 | Particulate Matter | 65.9 |
| TSP-2-078 | 5/3/99 | Total Lead | 0.087 | TSP-4-096 | 5/11/99 | Total Lead | 0.103 |
| TSP-3-079 | 5/3/99 | Particulate Matter | 95.3 | TSP-1-097 | 5/13/99 | Particulate Matter | 89.3 |
| TSP-3-079 | 5/3/99 | Total Lead | 0.104 | TSP-1-097 | 5/13/99 | Total Lead | 0.118 |
| TSP-4-080 | 5/3/99 | Particulate Matter | 137 | TSP-2-098 | 5/13/99 | Particulate Matter | 32.7 |
| TSP-4-080 | 5/3/99 | Total Lead | 0.691 | TSP-2-098 | 5/13/99 | Total Lead | 0.025 |
| TSP-1-081 | 5/4/99 | Particulate Matter | 185 | TSP-3-099 | 5/13/99 | Particulate Matter | 56200 |
| TSP-1-081 | 5/4/99 | Total Lead | 0.07 | TSP-3-099 | 5/13/99 | Total Lead | U |
| TSP-3-083 | 5/4/99 | Particulate Matter | 64.8 | TSP-4-100 | 5/13/99 | Particulate Matter | 40 |
| TSP-3-083 | 5/4/99 | Total Lead | 0.032 | TSP-4-100 | 5/13/99 | Total Lead | 0.082 |
| TSP-4-084 | 5/4/99 | Particulate Matter | 124 | TSP-1-101 | 5/17/99 | Particulate Matter | 78.9 |
| TSP-4-084 | 5/4/99 | Total Lead | 0.116 | TSP-1-101 | 5/17/99 | Total Lead | 0.148 |
| TSP-1-085 | 5/9/99 | Particulate Matter | 124 | TSP-2-102 | 5/17/99 | Particulate Matter | 41.1 |
| TSP-1-085 | 5/9/99 | Total Lead | 0.103 | TSP-2-102 | 5/17/99 | Total Lead | 0.117 |
| TSP-2-086 | 5/5/99 | Particulate Matter | 97.4 | TSP-4-104 | 5/17/99 | Particulate Matter | 59 |
| TSP-2-086 | 5/5/99 | Total Lead | 0.038 | TSP-4-104 | 5/17/99 | Total Lead | 0.161 |
| TSP-3-087 | 5/5/99 | Particulate Matter | 79.1 | TSP-1-109 | 5/18/99 | Particulate Matter | 173 |
| TSP-3-087 | 5/5/99 | Total Lead | 0.044 | TSP-1-109 | 5/18/99 | Total Lead | 0.181 |
| TSP-4-088 | 5/5/99 | Particulate Matter | 104 | TSP-2-110 | 5/18/99 | Particulate Matter | 101 |
| TSP-4-088 | 5/5/99 | Total Lead | 0.229 | TSP-2-110 | 5/18/99 | Total Lead | 0.172 |
| TSP-1-089 | 5/10/99 | Particulate Matter | 170 | TSP-4-112 | 5/18/99 | Particulate Matter | 109 |
| TSP-1-089 | 5/10/99 | Total Lead | 0.058 | TSP-4-112 | 5/18/99 | Total Lead | 0.111 |
| TSP-2-090 | 5/10/99 | Particulate Matter | 98.8 | TSP-3-113 | 5/19/99 | Particulate Matter | 188 |
| TSP-2-090 | 5/10/99 | Total Lead | 0.08 | TSP-3-113 | 5/19/99 | Total Lead | 0.188 |
| TSP-3-091 | 5/10/99 | Particulate Matter | 50 | TSP-2-114 | 5/19/99 | Particulate Matter | 131 |
| TSP-3-091 | 5/10/99 | Total Lead | 0.04 | TSP-2-114 | 5/19/99 | Total Lead | 0.105 |
| TSP-4-092 | 5/1/99 | Particulate Matter | 82.4 | TSP-4-116 | 5/19/99 | Particulate Matter | 78.3 |
| TSP-4-092 | 5/10/99 | Total Lead | 0.053 | TSP-4-116 | 5/19/99 | Total Lead | 0.141 |
| TSP-1-093 | 5/11/99 | Particulate Matter | 137 | TSP-1-117 | 5/20/99 | Particulate Matter | 132 |
| TSP-1-093 | 5/1/99 | Total Lead | 0.105 | TSP-1-117 | 5/20/99 | Total Lead | 0.199 |
| TSP-2-094 | 5/11/99 | Particulate Matter | 90.8 | TSP-2-118 | 5/20/99 | Particulate Matter | 112 |
| TSP-2-094 | 5/11/99 | Total Lead | 0.132 | TSP-2-118 | 5/20/99 | Total Lead | 0.217 |

*Total Lead results reported in ug/m3, Particulate Matter reported in ug/m3

Table B-6
TSP Air Monitoring Results
NL/Taracorp Superfund Site, Granite City, Illinois

| Sample ID | Date | Analyte | Result* |
|---|---|---|---|
| TSP-3-119 | 5/20/99 | Particulate Matter | 98.4 |
| TSP-3-119 | 5/20/99 | Total Lead | 0.255 |
| TSP-1-121 | 5/24/99 | Particulate Matter | 90000 |
| TSP-1-121 | 5/24/99 | Total Lead | 60 |
| TSP-2-122 | 5/24/99 | Particulate Matter | 73 |
| TSP-2-122 | 5/24/99 | Total Lead | 0.412 |
| TSP-3-123 | 5/24/99 | Particulate Matter | 65.4 |
| TSP-3-123 | 5/24/99 | Total Lead | 0.144 |
| TSP-4-124 | 5/24/99 | Particulate Matter | 76.4 |
| TSP-4-124 | 5/24/99 | Total Lead | 0.123 |
| TSP-2-126 | 5/25/99 | Particulate Matter | 80.6 |
| TSP-2-126 | 5/25/99 | Total Lead | 0.145 |
| TSP-3-127 | 5/25/99 | Particulate Matter | 49.6 |
| TSP-3-127 | 5/25/99 | Total Lead | 0.175 |
| TSP-4-128 | 5/25/99 | Particulate Matter | 80.6 |
| TSP-4-128 | 5/25/99 | Total Lead | 0.062 |
| TSP-1-129 | 5/26/99 | Particulate Matter | 148 |
| TSP-1-129 | 5/26/99 | Total Lead | 0.076 |
| TSP-3-131 | 5/26/99 | Particulate Matter | 87.8 |
| TSP-3-131 | 5/26/99 | Total Lead | 0.214 |
| TSP-4-132 | 5/26/99 | Particulate Matter | 103 |
| TSP-4-132 | 5/26/99 | Total Lead | 0.079 |
| TSP-1-133 | 5/27/99 | Particulate Matter | 207 |
| TSP-1-133 | 5/27/99 | Total Lead | 0.145 |
| TSP-2-134 | 5/27/99 | Particulate Matter | 186 |
| TSP-2-134 | 5/27/99 | Total Lead | 0.504 |
| TSP-3-135 | 5/27/99 | Particulate Matter | 150 |
| TSP-3-135 | 5/27/99 | Total Lead | 0.231 |
| TSP-4-136 | 5/27/99 | Particulate Matter | 188 |
| TSP-4-136 | 5/27/99 | Total Lead | 0.17 |
| TSP-1-137 | 6/1/99 | Particulate Matter | 74.8 |
| TSP-1-137 | 6/1/99 | Total Lead | 0.079 |
| TSP-3-139 | 6/1/99 | Particulate Matter | 48.2 |
| TSP-3-139 | 6/1/99 | Total Lead | 0.093 |
| TSP-4-140 | 6/1/99 | Particulate Matter | 40.9 |
| TSP-4-140 | 6/1/99 | Total Lead | 0.144 |
| TSP-1-141 | 6/2/99 | Particulate Matter | 375 |
| TSP-1-141 | 6/2/99 | Total Lead | 0.514 |
| TSP-2-142 | 6/2/99 | Particulate Matter | 118 |
| TSP-2-142 | 6/2/99 | Total Lead | 0.102 |
| TSP-3-143 | 6/2/99 | Particulate Matter | 72.5 |
| TSP-3-143 | 6/2/99 | Total Lead | 0.093 |
| TSP-4-144 | 6/2/99 | Particulate Matter | 62.2 |
| TSP-4-144 | 6/2/99 | Total Lead | U |
| TSP-1-145 | 6/3/99 | Particulate Matter | 258 |
| TSP-1-145 | 6/3/99 | Total Lead | 0.216 |
| TSP-2-146 | 6/3/99 | Particulate Matter | 148 |
| TSP-2-146 | 6/3/99 | Total Lead | 0.124 |
| TSP-3-147 | 6/3/99 | Particulate Matter | 110 |
| TSP-3-147 | 6/3/99 | Total Lead | 0.039 |
| TSP-4-148 | 6/3/99 | Particulate Matter | 72.2 |
| TSP-4-148 | 6/3/99 | Total Lead | 0.119 |
| TSP-B-001, B | 5/18/99 | Total Lead | U |
| TSP-B-002, B | 5/27/99 | Total Lead | U |

*Total Lead results reported in ug/m3, Particulate Matter reported in ug/m3

# Appendix B-7

## Personal Air Monitoring Sample Data

**Table B-7: Personal Air Monitoring Results**
**NL/Taracorp Superfund Site**
**Granite City, Illinois**

| Sample ID | Date | Analyte | Result ($\mu g/m^3$) | Sample ID | Date | Analyte | Result ($\mu g/m^3$) |
|---|---|---|---|---|---|---|---|
| PAS-P1-001 | 3/22/99 | Arsenic | U | PAS-P3-015 | 3/30/99 | Lead | 1.62 |
| PAS-P1-001 | 3/22/99 | Cadmium | U | PAS-P1-016 | 3/31/99 | Arsenic | U |
| PAS-P1-001 | 3/22/99 | Lead | U | PAS-P1-016 | 3/31/99 | Cadmium | U |
| PAS-P2-002 | 3/22/99 | Arsenic | U | PAS-P1-016 | 3/31/99 | Lead | 1.59 |
| PAS-P2-002 | 3/22/99 | Cadmium | U | PAS-P2-017 | 3/31/99 | Arsenic | U |
| PAS-P2-002 | 3/22/99 | Lead | U | PAS-P2-017 | 3/31/99 | Cadmium | U |
| PAS-P3-003 | 3/22/99 | Arsenic | U | PAS-P2-017 | 3/31/99 | Lead | 1.59 |
| PAS-P3-003 | 3/22/99 | Cadmium | U | PAS-P3-018 | 3/31/99 | Arsenic | U |
| PAS-P3-003 | 3/22/99 | Lead | U | PAS-P3-018 | 3/31/99 | Cadmium | U |
| PAS-P1-004 | 3/23/99 | Arsenic | U | PAS-P3-018 | 3/31/99 | Lead | 0.934 |
| PAS-P1-004 | 3/23/99 | Cadmium | U | PAS-P1-019 | 4/1/99 | Arsenic | U |
| PAS-P1-004 | 3/23/99 | Lead | 0.998 | PAS-P1-019 | 4/1/99 | Cadmium | U |
| PAS-P2-005 | 3/23/99 | Arsenic | U | PAS-P1-019 | 4/1/99 | Lead | U |
| PAS-P2-005 | 3/23/99 | Cadmium | U | PAS-P2-020 | 4/1/99 | Arsenic | U |
| PAS-P2-005 | 3/23/99 | Lead | 0.341 | PAS-P2-020 | 4/1/99 | Cadmium | U |
| PAS-P3-006 | 3/23/99 | Arsenic | U | PAS-P2-020 | 4/1/99 | Lead | 1 |
| PAS-P3-006 | 3/23/99 | Cadmium | U | PAS-P3-021 | 4/1/99 | Arsenic | U |
| PAS-P3-006 | 3/23/99 | Lead | 0.579 | PAS-P3-021 | 4/1/99 | Cadmium | U |
| PAS-P1-007 | 3/24/99 | Arsenic | U | PAS-P3-021 | 4/1/99 | Lead | U |
| PAS-P1-007 | 3/24/99 | Cadmium | U | PAS-P1-022 | 4/5/99 | Arsenic | U |
| PAS-P1-007 | 3/24/99 | Lead | U | PAS-P1-022 | 4/5/99 | Cadmium | U |
| PAS-P2-008 | 3/24/99 | Arsenic | U | PAS-P1-022 | 4/5/99 | Lead | 1.04 |
| PAS-P2-008 | 3/24/99 | Cadmium | U | PAS-P2-023 | 4/5/99 | Arsenic | U |
| PAS-P2-008 | 3/24/99 | Lead | U | PAS-P2-023 | 4/5/99 | Cadmium | U |
| PAS-P3-009 | 3/24/99 | Arsenic | U | PAS-P2-023 | 4/5/99 | Lead | 0.63 |
| PAS-P3-009 | 3/24/99 | Cadmium | U | PAS-P3-024 | 4/5/99 | Arsenic | U |
| PAS-P3-009 | 3/24/99 | Lead | U | PAS-P3-024 | 4/5/99 | Cadmium | U |
| PAS-P1-010 | 3/26/99 | Arsenic | U | PAS-P3-024 | 4/5/99 | Lead | U |
| PAS-P1-010 | 3/26/99 | Cadmium | U | PAS-P1-025 | 4/6/99 | Arsenic | U |
| PAS-P1-010 | 3/26/99 | Lead | U | PAS-P1-025 | 4/6/99 | Cadmium | U |
| PAS-P2-011 | 3/26/99 | Arsenic | U | PAS-P1-025 | 4/6/99 | Lead | 1.95 |
| PAS-P2-011 | 3/26/99 | Cadmium | U | PAS-P2-026 | 4/6/99 | Arsenic | 0.3 |
| PAS-P2-011 | 3/26/99 | Lead | 0.324 | PAS-P2-026 | 4/6/99 | Cadmium | U |
| PAS-P3-012 | 3/26/99 | Arsenic | U | PAS-P2-026 | 4/6/99 | Lead | 1.72 |
| PAS-P3-012 | 3/26/99 | Cadmium | U | PAS-P3-027 | 4/6/99 | Arsenic | 0.383 |
| PAS-P3-012 | 3/26/99 | Lead | 0.66 | PAS-P3-027 | 4/6/99 | Cadmium | 0.043 |
| PAS-BL-001 | 3/30/99 | Arsenic | U | PAS-P3-027 | 4/6/99 | Lead | 22.1 |
| PAS-BL-001 | 3/30/99 | Cadmium | U | PAS-P1-028 | 4/7/99 | Arsenic | U |
| PAS-BL-001 | 3/30/99 | Lead | U | PAS-P1-028 | 4/7/99 | Cadmium | 0.054 |
| PAS-P1-013 | 3/30/99 | Arsenic | U | PAS-P1-028 | 4/7/99 | Lead | 2.62 |
| PAS-P1-013 | 3/30/99 | Cadmium | U | PAS-P2-029 | 4/7/99 | Arsenic | U |
| PAS-P1-013 | 3/30/99 | Lead | 2.95 | PAS-P2-029 | 4/7/99 | Cadmium | U |
| PAS-P2-014 | 3/30/99 | Arsenic | U | PAS-P2-029 | 4/7/99 | Lead | 5.58 |

Table B-7: Personal Air Monitoring Results
NL/Taracorp Superfund Site
Granite City, Illinois

| Sample ID | Date | Analyte | Result (µg/m³) | Sample ID | Date | Analyte | Result (µg/m³) |
|---|---|---|---|---|---|---|---|
| PAS-P2-014 | 3/30/99 | Cadmium | U | PAS-P3-030 | 4/7/99 | Arsenic | U |
| PAS-P2-014 | 3/30/99 | Lead | 14.5 | PAS-P3-030 | 4/7/99 | Cadmium | U |
| PAS-P3-015 | 3/30/99 | Arsenic | U | PAS-P3-030 | 4/7/99 | Lead | 2.52 |
| PAS-P3-015 | 3/30/99 | Cadmium | U | PAS-P1-031 | 4/8/99 | Arsenic | U |
| PAS-P1-031 | 4/8/99 | Cadmium | U | PAS-P2-050 | 4/20/99 | Arsenic | U |
| PAS-P1-031 | 4/8/99 | Lead | 12.8 | PAS-P2-050 | 4/20/99 | Cadmium | U |
| PAS-P2-032 | 4/8/99 | Arsenic | U | PAS-P2-050 | 4/20/99 | Lead | 3.6 |
| PAS-P2-032 | 4/8/99 | Cadmium | U | PAS-P3-051 | 4/20/99 | Arsenic | U |
| PAS-P2-032 | 4/8/99 | Lead | 1.26 | PAS-P3-051 | 4/20/99 | Cadmium | U |
| PAS-P3-033 | 4/8/99 | Arsenic | U | PAS-P3-051 | 4/20/99 | Lead | 1.39 |
| PAS-P3-033 | 4/8/99 | Cadmium | U | PAS-P1-052 | 4/21/99 | Arsenic | U |
| PAS-P3-033 | 4/8/99 | Lead | 1.52 | PAS-P1-052 | 4/21/99 | Cadmium | U |
| PAS-P1-034 | 4/12/99 | Arsenic | 0.354 | PAS-P1-052 | 4/21/99 | Lead | 1.29 |
| PAS-P1-034 | 4/12/99 | Cadmium | U | PAS-P2-053 | 4/21/99 | Arsenic | U |
| PAS-P1-034 | 4/12/99 | Lead | 29.8 | PAS-P2-053 | 4/21/99 | Cadmium | U |
| PAS-P2-035 | 4/12/99 | Arsenic | U | PAS-P2-053 | 4/21/99 | Lead | 0.473 |
| PAS-P2-035 | 4/12/99 | Cadmium | U | PAS-P3-054 | 4/21/99 | Arsenic | U |
| PAS-P2-035 | 4/12/99 | Lead | 9.96 | PAS-P3-054 | 4/21/99 | Cadmium | U |
| PAS-P3-036 | 4/12/99 | Arsenic | U | PAS-P3-054 | 4/21/99 | Lead | 2.67 |
| PAS-P3-036 | 4/12/99 | Cadmium | U | PAS-P1-043 | 4/15/99 | Arsenic | U |
| PAS-P3-036 | 4/12/99 | Lead | 3.52 | PAS-P1-043 | 4/15/99 | Cadmium | 0.091 |
| PAS-P1-037 | 4/13/99 | Arsenic | U | PAS-P1-043 | 4/15/99 | Lead | 4.12 |
| PAS-P1-037 | 4/13/99 | Cadmium | U | PAS-P2-044 | 4/15/99 | Arsenic | U |
| PAS-P1-037 | 4/13/99 | Lead | 4.36 | PAS-P2-044 | 4/15/99 | Cadmium | U |
| PAS-P2-038 | 4/13/99 | Arsenic | U | PAS-P2-044 | 4/15/99 | Lead | 2.95 |
| PAS-P2-038 | 4/13/99 | Cadmium | U | PAS-P3-045 | 4/15/99 | Arsenic | U |
| PAS-P2-038 | 4/13/99 | Lead | 3.97 | PAS-P3-045 | 4/15/99 | Cadmium | 0.108 |
| PAS-P3-039 | 4/13/99 | Arsenic | U | PAS-P3-045 | 4/15/99 | Lead | 7.56 |
| PAS-P3-039 | 4/13/99 | Cadmium | U | PAS-P1-055 | 4/22/99 | Arsenic | U |
| PAS-P3-039 | 4/13/99 | Lead | 0.477 | PAS-P1-055 | 4/22/99 | Cadmium | 0.0767 |
| PAS-P1-040 | 4/14/99 | Arsenic | 0.294 | PAS-P1-055 | 4/22/99 | Lead | 5.13 |
| PAS-P1-040 | 4/14/99 | Cadmium | U | PAS-P2-056 | 4/22/99 | Arsenic | U |
| PAS-P1-040 | 4/14/99 | Lead | 3.38 | PAS-P2-056 | 4/22/99 | Cadmium | U |
| PAS-P2-041 | 4/14/99 | Arsenic | U | PAS-P2-056 | 4/22/99 | Lead | U |
| PAS-P2-041 | 4/14/99 | Cadmium | U | PAS-P3-057 | 4/22/99 | Arsenic | U |
| PAS-P2-041 | 4/14/99 | Lead | 5.46 | PAS-P3-057 | 4/22/99 | Cadmium | U |
| PAS-P3-042 | 4/14/99 | Arsenic | U | PAS-P3-057 | 4/22/99 | Lead | 3.32 |
| PAS-P3-042 | 4/14/99 | Cadmium | U | PAS-P1-060 | 4/23/99 | Arsenic | U |
| PAS-P3-042 | 4/14/99 | Lead | 7.11 | PAS-P1-060 | 4/23/99 | Cadmium | U |
| PAS-P1-046 | 4/16/99 | Arsenic | U | PAS-P1-060 | 4/23/99 | Lead | 7.18 |
| PAS-P1-046 | 4/16/99 | Cadmium | U | PAS-P2-061 | 4/23/99 | Arsenic | U |
| PAS-P1-046 | 4/16/99 | Lead | U | PAS-P2-061 | 4/23/99 | Cadmium | 0.046 |
| PAS-P2-047 | 4/16/99 | Arsenic | U | PAS-P2-061 | 4/23/99 | Lead | 11.3 |

**Table B-7: Personal Air Monitoring Results**
**NL/Taracorp Superfund Site**
**Granite City, Illinois**

| Sample ID | Date | Analyte | Result ($\mu g/m^3$) | Sample ID | Date | Analyte | Result ($\mu g/m^3$) |
|---|---|---|---|---|---|---|---|
| PAS-P2-047 | 4/16/99 | Cadmium | U | PAS-P3-062 | 4/23/99 | Arsenic | U |
| PAS-P2-047 | 4/16/99 | Lead | 6.93 | PAS-P3-062 | 4/23/99 | Cadmium | U |
| PAS-P3-048 | 4/16/99 | Arsenic | U | PAS-P3-062 | 4/23/99 | Lead | 8.62 |
| PAS-P3-048 | 4/16/99 | Cadmium | U | PAS-P1-063 | 4/26/99 | Lead | U |
| PAS-P3-048 | 4/16/99 | Lead | 0.616 | PAS-P2-064 | 4/26/99 | Lead | 18.8 |
| PAS-P1-049 | 4/20/99 | Arsenic | U | PAS-P3-065 | 4/26/99 | Lead | U |
| PAS-P1-049 | 4/20/99 | Cadmium | U | PAS-P1-066 | 4/27/99 | Lead | 1.7 |
| PAS-P1-049 | 4/20/99 | Lead | 22 | PAS-P2-067 | 4/27/99 | Lead | 1.2 |
| PAS-P1-069 | 4/28/99 | Lead | 4.7 | PAS-P3-087 | 5/11/99 | Lead | 3.95 |
| PAS-P2-070 | 4/28/99 | Lead | 33.8 | PAS-P1-088 | 5/12/99 | Arsenic | U |
| PAS-P3-071 | 4/28/99 | Lead | U | PAS-P1-088 | 5/12/99 | Cadmium | U |
| PAS-P1-073 | 5/3/99 | Arsenic | U | PAS-P1-088 | 5/12/99 | Lead | 1.55 |
| PAS-P1-073 | 5/3/99 | Cadmium | U | PAS-P2-089 | 5/12/99 | Arsenic | U |
| PAS-P1-073 | 5/3/99 | Lead | 3.86 | PAS-P2-089 | 5/12/99 | Cadmium | U |
| PAS-P2-074 | 5/3/99 | Arsenic | U | PAS-P2-089 | 5/12/99 | Lead | 2.53 |
| PAS-P2-074 | 5/3/99 | Cadmium | U | PAS-P3-090 | 5/12/99 | Arsenic | U |
| PAS-P2-074 | 5/3/99 | Lead | 1.01 | PAS-P3-090 | 5/12/99 | Cadmium | U |
| PAS-P3-075 | 5/3/99 | Arsenic | U | PAS-P3-090 | 5/12/99 | Lead | U |
| PAS-P3-075 | 5/3/99 | Cadmium | U | PAS-P1-091 | 5/13/99 | Arsenic | U |
| PAS-P3-075 | 5/3/99 | Lead | 11.1 | PAS-P1-091 | 5/13/99 | Cadmium | U |
| PAS-P1-076 | 5/4/99 | Arsenic | U | PAS-P1-091 | 5/13/99 | Lead | 27.8 |
| PAS-P1-076 | 5/4/99 | Cadmium | U | PAS-P2-092 | 5/13/99 | Arsenic | U |
| PAS-P1-076 | 5/4/99 | Lead | 11.4 | PAS-P2-092 | 5/13/99 | Cadmium | U |
| PAS-P2-077 | 5/4/99 | Arsenic | U | PAS-P2-092 | 5/13/99 | Lead | 2.1 |
| PAS-P2-077 | 5/4/99 | Cadmium | U | PAS-P3-093 | 5/13/99 | Arsenic | U |
| PAS-P2-077 | 5/4/99 | Lead | 2.28 | PAS-P3-093 | 5/13/99 | Cadmium | U |
| PAS-P3-078 | 5/4/99 | Arsenic | U | PAS-P3-093 | 5/13/99 | Lead | 0.521 |
| PAS-P3-078 | 5/4/99 | Cadmium | U | PAS-P1-094 | 5/18/99 | Arsenic | U |
| PAS-P3-078 | 5/4/99 | Lead | 4.19 | PAS-P1-094 | 5/18/99 | Cadmium | U |
| PAS-P1-079 | 5/7/99 | Arsenic | U | PAS-P1-094 | 5/18/99 | Lead | 3.63 |
| PAS-P1-079 | 5/7/99 | Cadmium | U | PAS-P2-095 | 5/18/99 | Arsenic | U |
| PAS-P1-079 | 5/7/99 | Lead | 1.57 | PAS-P2-095 | 5/18/99 | Cadmium | U |
| PAS-P2-080 | 5/7/99 | Arsenic | U | PAS-P2-095 | 5/18/99 | Lead | 3.37 |
| PAS-P2-080 | 5/7/99 | Cadmium | U | PAS-P3-096 | 5/18/99 | Arsenic | U |
| PAS-P2-080 | 5/7/99 | Lead | 1.72 | PAS-P3-096 | 5/18/99 | Cadmium | U |
| PAS-P3-081 | 5/7/99 | Arsenic | U | PAS-P3-096 | 5/18/99 | Lead | U |
| PAS-P3-081 | 5/7/99 | Cadmium | U | PAS-P1-097 | 5/19/99 | Arsenic | U |
| PAS-P3-081 | 5/7/99 | Lead | 2.16 | PAS-P1-097 | 5/19/99 | Cadmium | U |
| PAS-P1-082 | 5/10/99 | Arsenic | U | PAS-P1-097 | 5/19/99 | Lead | 5.34 |
| PAS-P1-082 | 5/10/99 | Cadmium | U | PAS-P2-098 | 5/19/99 | Arsenic | U |
| PAS-P1-082 | 5/10/99 | Lead | 2.95 | PAS-P2-098 | 5/19/99 | Cadmium | U |
| PAS-P2-083 | 5/10/99 | Arsenic | U | PAS-P2-098 | 5/19/99 | Lead | 1.43 |
| PAS-P2-083 | 5/10/99 | Cadmium | U | PAS-P2-099 | 5/19/99 | Arsenic | U |

**Table B-7: Personal Air Monitoring Results**
**NL/Taracorp Superfund Site**
**Granite City, Illinois**

| Sample ID | Date | Analyte | Result ($\mu g/m^3$) | Sample ID | Date | Analyte | Result ($\mu g/m^3$) |
|---|---|---|---|---|---|---|---|
| PAS-P2-083 | 5/10/99 | Lead | 6.02 | PAS-P2-099 | 5/19/99 | Cadmium | U |
| PAS-P3-084 | 5/10/99 | Arsenic | U | PAS-P2-099 | 5/19/99 | Lead | 1.72 |
| PAS-P3-084 | 5/10/99 | Cadmium | U | PAS-P1-100 | 5/20/99 | Arsenic | U |
| PAS-P3-084 | 5/10/99 | Lead | 4.75 | PAS-P1-100 | 5/20/99 | Cadmium | U |
| PAS-P1-085 | 5/11/99 | Arsenic | U | PAS-P1-100 | 5/20/99 | Lead | 2.39 |
| PAS-P1-085 | 5/11/99 | Cadmium | U | PAS-P2-101 | 5/20/99 | Arsenic | U |
| PAS-P1-085 | 5/11/99 | Lead | U | PAS-P2-101 | 5/20/99 | Cadmium | U |
| PAS-P2-086 | 5/11/99 | Arsenic | U | PAS-P2-101 | 5/20/99 | Lead | 2.42 |
| PAS-P2-086 | 5/11/99 | Cadmium | U | PAS-P3-102 | 5/20/99 | Arsenic | U |
| PAS-P2-086 | 5/11/99 | Lead | 5.4 | PAS-P3-102 | 5/20/99 | Cadmium | U |
| PAS-P3-087 | 5/11/99 | Arsenic | U | PAS-P3-102 | 5/20/99 | Lead | U |
| PAS-P3-087 | 5/11/99 | Cadmium | U | PAS-P1-103 | 5/21/99 | Arsenic | U |
| PAS-P1-103 | 5/21/99 | Cadmium | U | PAS-P1-121 | 6/4/99 | Arsenic | U |
| PAS-P1-103 | 5/21/99 | Lead | 3.39 | PAS-P1-121 | 6/4/99 | Cadmium | U |
| PAS-P2-104 | 5/21/99 | Arsenic | U | PAS-P1-121 | 6/4/99 | Lead | 3.48 |
| PAS-P2-104 | 5/21/99 | Cadmium | U | PAS-P2-122 | 6/4/99 | Arsenic | U |
| PAS-P2-104 | 5/21/99 | Lead | 2.25 | PAS-P2-122 | 6/4/99 | Cadmium | U |
| PAS-P3-105 | 5/21/99 | Arsenic | U | PAS-P2-122 | 6/4/99 | Lead | 0.581 |
| PAS-P3-105 | 5/21/99 | Cadmium | U | PAS-P3-123 | 6/4/99 | Arsenic | 0.509 |
| PAS-P3-105 | 5/21/99 | Lead | 1.07 | PAS-P3-123 | 6/4/99 | Cadmium | U |
| PAS-P1-106 | 5/24/99 | Arsenic | U | PAS-P3-123 | 6/4/99 | Lead | 21.1 |
| PAS-P1-106 | 5/24/99 | Cadmium | U | PAS-P1-124 | 6/7/99 | Lead | 0.473 |
| PAS-P1-106 | 5/24/99 | Lead | 2.17 | PAS-P2-125 | 6/7/99 | Lead | 1.42 |
| PAS-P2-107 | 5/24/99 | Arsenic | U | PAS-P3-126 | 6/7/99 | Lead | 1.62 |
| PAS-P2-107 | 5/24/99 | Cadmium | U | PAS-P2-128 | 6/8/99 | Lead | U |
| PAS-P2-107 | 5/24/99 | Lead | 3.88 | PAS-P3-129 | 6/8/99 | Lead | 0.551 |
| PAS-P3-108 | 5/24/99 | Arsenic | U | PAS-P1-130 | 6/9/99 | Lead | 2.16 |
| PAS-P3-108 | 5/24/99 | Cadmium | U | PAS-P3-132 | 6/9/99 | Lead | 0.995 |
| PAS-P3-108 | 5/24/99 | Lead | 0.93 | PAS-P1-133 | 6/10/99 | Lead | 0.652 |
| PAS-P2-110 | 5/25/99 | Arsenic | U | PAS-P2-134 | 6/10/99 | Lead | 0.991 |
| PAS-P2-110 | 5/25/99 | Cadmium | U | PAS-P3-135 | 6/10/99 | Lead | U |
| PAS-P2-110 | 5/25/99 | Lead | U | PAS-P1-136A | 6/11/99 | Lead | 2.07 |
| PAS-P3-111 | 5/25/99 | Arsenic | U | PAS-P2-137A | 6/11/99 | Lead | 3.54 |
| PAS-P3-111 | 5/25/99 | Cadmium | U | PAS-P3-138A | 6/11/99 | Lead | 1.89 |
| PAS-P3-111 | 5/25/99 | Lead | 6.21 | PAS-P1-136B | 6/14/99 | Lead | 1.29 |
| PAS-P2-113 | 5/26/99 | Arsenic | U | PAS-P2-137B | 6/14/99 | Lead | 9.39 |
| PAS-P2-113 | 5/26/99 | Cadmium | U | PAS-P3-138B | 6/14/99 | Lead | 2.03 |
| PAS-P2-113 | 5/26/99 | Lead | 2.58 | PAS-P1-139 | 6/15/99 | Lead | 2.06 |
| PAS-P3-114 | 5/26/99 | Arsenic | U | PAS-P2-140 | 6/15/99 | Lead | 22.2 |
| PAS-P3-114 | 5/26/99 | Cadmium | U | PAS-P3-141 | 6/15/99 | Lead | 1.15 |
| PAS-P3-114 | 5/26/99 | Lead | 1.61 | PAS-P1-142A | 6/17/99 | Lead | 7.64 |
| PAS-P1-115 | 6/2/99 | Arsenic | U | PAS-P2-143A | 6/17/99 | Lead | 2.78 |
| PAS-P1-115 | 6/2/99 | Cadmium | U | PAS-P3-144A | 6/17/99 | Lead | 1.4 |

**Table B-7: Personal Air Monitoring Results**
**NL/Taracorp Superfund Site**
**Granite City, Illinois**

| Sample ID | Date | Analyte | Result ($\mu g/m^3$) | Sample ID | Date | Analyte | Result ($\mu g/m^3$) |
|---|---|---|---|---|---|---|---|
| PAS-P1-115 | 6/2/99 | Lead | 0.963 | PAS-P1-142B | 6/18/99 | Lead | 2.5 |
| PAS-P2-116 | 6/2/99 | Arsenic | U | PAS-P2-143B | 6/18/99 | Lead | U |
| PAS-P2-116 | 6/2/99 | Cadmium | U | | | | |
| PAS-P2-116 | 6/2/99 | Lead | 0.356 | | | | |
| PAS-P3-117 | 6/2/99 | Arsenic | U | | | | |
| PAS-P3-117 | 6/2/99 | Cadmium | U | | | | |
| PAS-P3-117 | 6/2/99 | Lead | 0.808 | | | | |
| PAS-P1-118 | 6/3/99 | Arsenic | U | | | | |
| PAS-P1-118 | 6/3/99 | Cadmium | U | | | | |
| PAS-P1-118 | 6/3/99 | Lead | 1.9 | | | | |
| PAS-P2-119 | 6/3/99 | Arsenic | U | | | | |
| PAS-P2-119 | 6/3/99 | Cadmium | U | | | | |
| PAS-P2-119 | 6/3/99 | Lead | 1.02 | | | | |
| PAS-P3-120 | 6/3/99 | Arsenic | U | | | | |
| PAS-P3-120 | 6/3/99 | Cadmium | U | | | | |
| PAS-P3-120 | 6/3/99 | Lead | 2.01 | | | | |

ENTACT

# Appendix C

Appendix C

# APPENDIX C

# GEOTECHNICAL TEST DATA

HTS, INC.
Consultants

416 PICKERING STREET • HOUSTON, TEXAS 77091
713/692-8373 • 800/692-TEST • FAX 713/692-8502

May 24, 1999

| HTS Report #: | E1300.001.doc |
|---|---|

| | | |
|---|---|---|
| Mr. Dan Rest | Customer Project Name: | |
| Entact | Customer Project #: | |
| 2245 Adams ST | Lab Temperature: | 71 degrees F. |
| Granite City, IL 62040 | Lab Humidity: | 50% |

The following 2 samples were delivered to our laboratory on 05/20/99.

| SAMPLES RECEIVED | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Sample I.D. | Mat'l Type | | Sample I.D. | Mat'l Type | | Sample I.D. | Mat'l Type |
| 1 | 00000282 | GCL | 6 | | | 11 | | |
| 2 | 200000387 | GT | 7 | | | 12 | | |
| 3 | | | 8 | | | 13 | | |
| 4 | | | 9 | | | 14 | | |
| 5 | | | 10 | | | 15 | | |

Conformance testing was performed in accordance with the following test methods. The test results are summarized on the subsequent pages. It should be noted that the test specimens and test sample used for this work were believed to be ·esentative of the material produced under this designation. However, these results are indicative only of the ·cimens that were actually tested. HTS, Inc. neither accepts responsibility for nor makes claims to the final use and purpose of the material.

| TESTING PERFORMED | TESTING PERFORMED |
|---|---|
| ASTM D 5261 – Mass Per Unit Area | ASTM D 3786 – Hydraulic Bursting Strength |
| ASTM D 4751 – Apparent Opening Size | |
| ASTM D 4491 – Permittivity | |
| ASTM D 4833 – Puncture Resistance | |
| ASTM D 4632 – Grab Tensile Properties | |
| ASTM D 4533 – Trapezoidal Tearing Strength | |

Very truly yours,

Larry L. McMichael

Larry L. McMichael KP
Vice President



ENVIRONMENTAL • GEOTECHNICAL ENGINEERING • CONSTRUCTION MATERIALS TESTING • ANALYTICAL SERVICES
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## MASS PER UNIT AREA – ASTM D 5261

**Bentonite @ 25 % Moisture**

Sample Type: ASTM Specimen: 4" X 8"

| Sample | Spec. # | Mass Per Unit Area (lbs/ft$^2$) |
|---|---|---|
| Roll #00000282 | 1 | 1.34 |
| Lot #199918030 | 2 | 1.32 |
| | 3 | 1.32 |
| | 4 | 1.33 |
| | 5 | 1.29 |
| | Avg. | 1.32 |

## APPARENT OPENING SIZE – ASTM D 4751

Sample Type: ASTM

| Sample | Spec. # | Percent Beads Passing Through (%) | Bead Size Ranges (mm) | AOS |
|---|---|---|---|---|
| Roll #200000387 | 1 | 1.4 | .150 | 100 |
| Lot # 132 | 2 | 1.4 | .150 | 100 |
| | 3 | 0.8 | .150 | 100 |
| | 4 | 0.4 | .150 | 100 |
| | 5 | 0.4 | .150 | 100 |
| | Avg. | | .150 | 100 |

## PERMITTIVITY – ASTM D 4491

Sample Type: ASTM
Apparatus: Constant & Falling Head Permeability (ASTM Figure 1)
Constant Head Test @ 2 Inches

| | | Permittivity ($Sec^{-1}$) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sample** | **Spec. #** | **1** | **2** | **3** | **4** | **5** | **Avg.** | **S.D.** |
| Roll | 1 | 1.67 | 1.68 | 1.63 | 1.65 | 1.61 | 1.65 | .03 |
| #200000387 | 2 | 1.81 | 1.80 | 1.80 | 1.79 | 1.79 | 1.80 | .01 |
| Lot # 132 | 3 | 1.68 | 1.67 | 1.67 | 1.67 | 1.65 | 1.67 | .01 |
| | 4 | 1.54 | 1.50 | 1.49 | 1.48 | 1.48 | 1.50 | .03 |
| | Avg. | | | | | | 1.66 | |



HTS, INC.
Consultants

## PUNCTURE RESISTANCE – ASTM D 4833

Instron Series IX Automated Materials Testing System

| | |
|---|---|
| Sample Type: ASTM | Cross Head Speed (in/min): 12.0 |
| Sample Size: 4" diameter | Spec. Gauge Length (in): .087 |
| Area ($in^2$): 2.4660 | Platen Separation (in): .087 |

| Sample | Spec. # | Maximum Load (lbs) |
|---|---|---|
| Roll #200000387 | 1 | 145 |
| Lot # 132 | 2 | 120 |
| | 3 | 136 |
| | 4 | 109 |
| | 5 | 113 |
| | 6 | 118 |
| | 7 | 138 |
| | 8 | 120 |
| | 9 | 123 |
| | 10 | 125 |
| | 11 | 117 |
| | 12 | 110 |
| | 13 | 115 |
| | 14 | 145 |
| | 15 | 118 |
| | Avg. | 123 |
| | S.D. | 12 |

## GRAB TENSILE PROPERTIES – ASTM D 4632

Instron Series IX Automated Materials Testing System

| | |
|---|---|
| Sample Type: ASTM | Cross Head Speed (in/min): 12.0000 |
| Width (in): 4.0 | Spec. Gauge Length (in): 3.000 |
| Thickness (in): .087 | Grip Distance (in): 3.000 |

| | | Maximum Load (lbs) | | Elongation (%) | |
|---|---|---|---|---|---|
| **Sample** | **Spec. #** | **MD** | **XD** | **MD** | **XD** |
| Roll #200000387 | 1 | 206.0 | 238.1 | 79.9 | 81.5 |
| Lot # 132 | 2 | 215.0 | 200.4 | 87.8 | 81.1 |
| | 3 | 224.8 | 222.4 | 83.1 | 83.8 |
| | 4 | 214.4 | 207.1 | 74.3 | 76.0 |
| | 5 | 196.1 | 190.3 | 75.6 | 90.2 |
| | 6 | 200.8 | 220.8 | 79.7 | 89.0 |
| | 7 | 201.6 | 180.2 | 79.1 | 91.3 |
| | 8 | 193.6 | 207.0 | 80.6 | 89.3 |
| | 9 | 225.1 | 217.3 | 82.9 | 86.3 |
| | 10 | 203.2 | 207.4 | 72.8 | 84.5 |
| | Avg. | 208.1 | 209.1 | 79.6 | 85.3 |
| | S.D. | 11.2 | 16.7 | 4.5 | 4.9 |

| TRAPEZOIDAL TEARING STRENGTH – ASTM D 4533 | |
|---|---|
| Instron Series IX Automated Materials Testing System | |
| Sample Type: ASTM | Cross Head Speed (in/min): 12.0000 |
| Width (in): 3 | Spec. Gauge Length (in): 1 |
| Thickness (in): .087 | Grip Distance (in): 1 |

| | | Maximum Load (lbs) | |
|---|---|---|---|
| **Sample** | **Spec. #** | **MD** | **XD** |
| Roll #200000387 | 1 | 78.31 | 77.50 |
| Lot # 132 | 2 | 99.33 | 102.00 |
| | 3 | 84.70 | 113.70 |
| | 4 | 90.52 | 105.00 |
| | 5 | 89.42 | 96.91 |
| | 6 | 87.76 | 105.10 |
| | 7 | 86.17 | 93.02 |
| | 8 | 97.93 | 83.33 |
| | 9 | 79.68 | 113.50 |
| | 10 | 80.91 | 97.56 |
| | Avg. | 87.47 | 98.76 |
| | S.D. | 7.15 | 11.82 |

## HYDRAULIC BURSTING STRENGTH – ASTM D 3786

Sample Type: ASTM

Hydraulic Diaphragm Bursting Tester: Model A

| Sample | Spec. # | Bursting Strength (psi) |
|---|---|---|
| Roll #200000387 | 1 | 395 |
| Lot # 132 | 2 | 330 |
| | 3 | 305 |
| | 4 | 300 |
| | 5 | 370 |
| | 6 | 355 |
| | 7 | 370 |
| | 8 | 365 |
| | 9 | 350 |
| | 10 | 350 |
| | Avg. | 349 |



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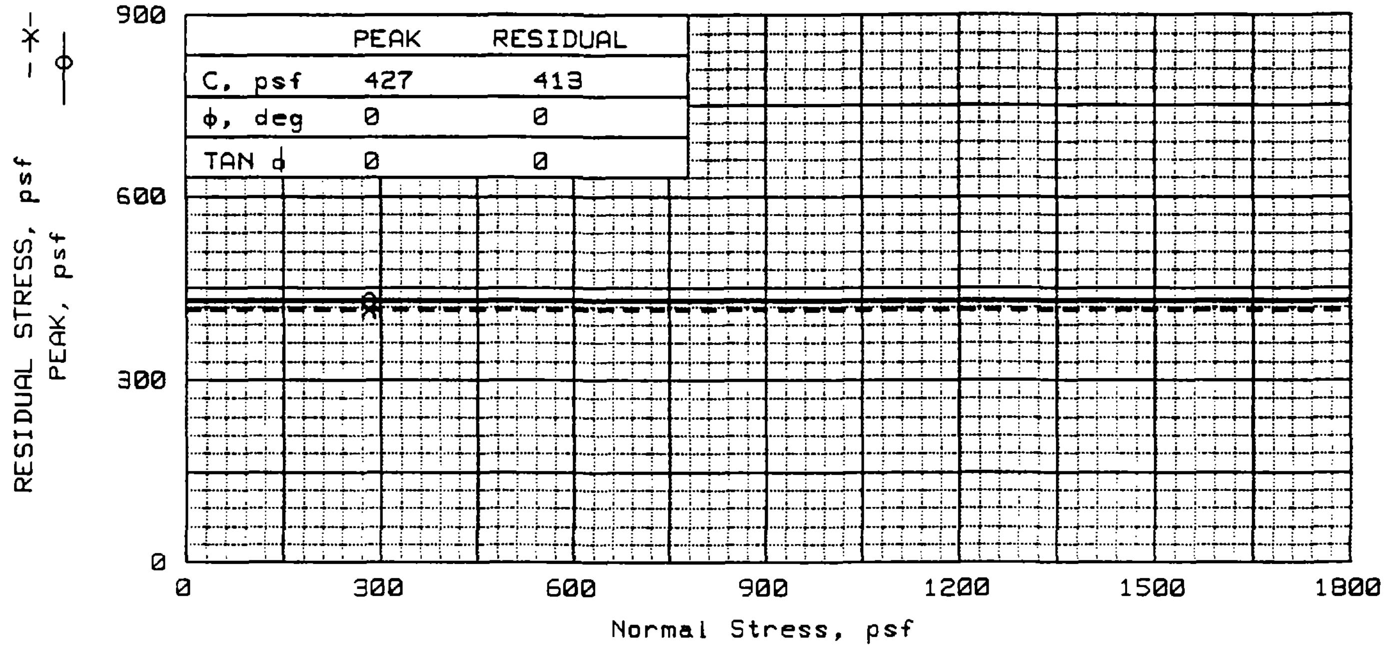
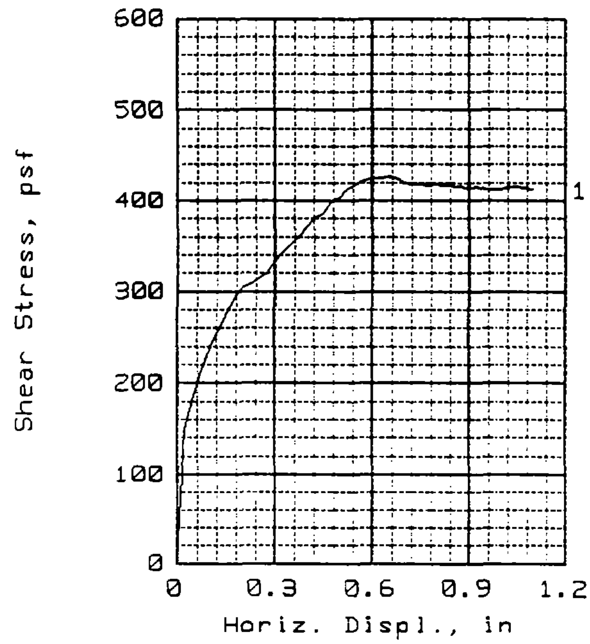



| | PEAK | RESIDUAL |
|---|---|---|
| C, psf | 427 | 413 |
| ϕ, deg | 0 | 0 |
| TAN ϕ | 0 | 0 |




| | | |
|---|---|---|
| SPECIMEN NO.: | | 1 |
| INITIAL | WATER CONTENT, % | 0.0 |
| | DRY DENSITY, pcf | N/A |
| | SATURATION, % | |
| | VOID RATIO | |
| | SIDE LENGTH, in | 12.00 |
| | HEIGHT, in | N/A |
| AT TEST | WATER CONTENT, % | 0.0 |
| | DRY DENSITY, pcf | N/A |
| | SATURATION, % | |
| | VOID RATIO | |
| | SIDE LENGTH, in | 12.00 |
| | HEIGHT, in | N/A |
| NORMAL STRESS, psf | | 288 |
| PEAK, psf | | 427 |
| DISPLACEMENT, in | | 0.65 |
| RESIDUAL STRESS, psf | | 413 |
| DISPLACEMENT, in | | 1.10 |
| Strain rate, in/min | | 0.0065 |

SAMPLE TYPE: ASTM D 5321
DESCRIPTION: INTERNAL/FRICTION
SAMPLE SATURATED FOR 72 HRS

SPECIFIC GRAVITY=
REMARKS: R-GCL ROLL #00000282
LOT #199918030

Fig. No.: 1

CLIENT: ENTACT

PROJECT:

SAMPLE LOCATION:

PROJ. NO.: E1300.001 DATE: 05/24/99

DIRECT SHEAR TEST REPORT

HTS, INC. Consultants

**HTS, INC.**
*Consultants*

July 20, 1999

Entact
2245 Adams Street
Granite City, Illinois 62040

Attn: Mr. Dan Rest

Re: Letter Report
Geosynthetics Direct Shear
Interface Friction Testing
NL Industries/TaraCorp Site
HTS Report No. EI1300.003

Dear Mr. Rest:

## 1.0 INTRODUCTION AND SUMMARY

This letter presents test results for direct shear interface friction tests performed by HTS, Inc. Consultants (HTS) on geosynthetics used during construction of the referenced project. Interface friction tests were conducted by using test configurations which measured:

- Interface friction angle of project soil cover against (over) TNS Advanced Technologies 10 TNS geogrid.
- Interface friction angle of TNS Advanced Technologies 10 TNS geogrid against (over) Skaps Industries 220-2-7 geocomposite.
- Interface friction angle of Skaps Industries 220-2-7 geocomposite against (over) Serrot Corporation 40 mil LLDPE textured geomembrane.
- Interface friction angle of Serrot Corporation 40 mil LLDPE textured geomembrane against (over) CETCO Bentomat ST 150 geosynthetic clay liner.
- Interface friction angle of CETCO Bentomat ST 150 geosynthetic clay liner against (over) bottom soil.
- Interface friction angle of project soil cover against (over) Skaps Industries 220-2-7 geocomposite.

The peak and residual interface friction angles and adhesion values for the above test configurations are summarized in Table 1 below. Data and data plots of shear stress versus normal stress and shear stress versus horizontal displacement for the tests performed are shown in Figures 1 through 6.

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## TABLE 1
## SUMMARY OF INTERFACE FRICTION TEST RESULTS

| Test Configuration | Hydration Time (hours) | Direct Shear Strain Rate (inches per Minute) | Peak Shear Strength | | Residual Shear Strength | |
|---|---|---|---|---|---|---|
| | | | Friction Angle (degrees) | Adhesion (psf) | Friction Angle (degrees) | Adhesion (psf) |
| Cover soil against (over) TNS Advanced Technologies 10 TNS geogrid | 24 | 0.04 | 35.5 | 469 | 33.9 | 384 |
| TNS Advanced Technologies 10 TNS Geogrid against (over) Skaps Industies 220-2-7 geocomposite | 24 | 0.04 | 20.9 | 0 | 12.9 | 0 |
| Skaps Industries 220-2-7 Geocomposite against (over) Serrot Corp. LLDPE 40 mil textured geomembrane | 24 | 0.04 | 30.0 | 461 | 25.5 | 440 |
| Serrot Corporation LLDPE 40 mil Textured geomembrane against (over) CETCO Bentomat ST 150 geosynthetic clay liner | 24 | 0.04 | 40.0 | 160 | 39.0 | 67 |
| CETCO Bentomat ST 150 Geosynthetic clay liner against (over) bottom soil | 24 | 0.04 | 31.4 | 14.4 | 31.0 | 12.1 |
| Soil against (over) Skaps Industries 220-2-7 geocomposite | 24 | 0.04 | 31.6 | 501 | 24.5 | 462 |

## 2.0 . TESTING EQUIPMENT AND TEST PROCEDURES

### 2.1 Test Equipment

HTS' large scale direct shear box used for the testing described in this report consists of a Brainard Kilman model LG 115 which has a 12 inch x 12 inch x 4 inch upper box and a 12 inch x 16 inch x 4 inch lower box. The lower box is 16 inches in length in order to afford a full 12 inch x 12 inch interface during testing. The lower box is mounted on low-friction rollers and attached to an acme thread piston that applies the shearing force and subsequent displacement relative to the upper stationary box. For the testing described in this report, the normal load was applied by means of a rigid load platen installed on the upper box. The data were recorded directly from the LG 115 direct shear device into a 386 computer. Direct readings were also made from an in-line air pressure transducer and the digital readout on the LG 115 direct shear device. All testing was performed by using calibrated testing equipment. HTS' geosynthetic testing laboratory equipment and test procedures are accredited by the Geosynthetic Accreditation Institute and the American Association for Laboratory Accreditation.

All testing was performed under the direction of a registered professional engineer.

## 2.2 Preparation of Test Specimens

The geosynthetic liner materials were placed in the direct shear box using the following procedures:

- The upper box inside faces were coated with silicone high vacuum grease to prevent friction.
- Plastic velcro incorporated into plastic plates was used to prevent slippage or bowing of the GCL, geogrid, geocomposite, and textured geomembrane during interface testing.
- Geosynthetic samples were trimmed in order to fit the lower or upper box dimensions and securely anchored with bar clamps to prevent slippage during testing.
- Rigid polyvinyl plates were placed in the lower and upper shear boxes to provide rigid support during geosynthetic shear testing.
- Individual samples were placed in the shear box for testing at each normal compressive load.
- Each interface configuration was loaded to the specified normal stress and saturated under the applied load for 24 hours prior to testing.

## 2.3 Test Procedures

The direct shear interface friction tests were conducted in strict accordance with ASTM Designation D5321-92 entitled "Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method". The tests were performed using representative samples of the geosynthetic materials to be used in the construction of this project. Samples of project cover soil and bottom soil were provided to HTS. Moisture Density Relations (ASTM D 1557-91 modified proctor tests) were performed on each soil type in HTS' laboratory. The soils were placed into the shear box and compacted to 90% of the modified proctor. Proctor test reports for each type of soil are attached to this report. The geosynthetic and soil samples were located and oriented in the direct shear device in order to replicate the placement/application of the materials in the field. Three separate normal stresses of 288 psf, 576 psf, and 864 psf were used to define the shear stress versus normal stress. Separate samples were placed in the direct shear device for each normal load. The interfaces tested were sheared at a constant rate of displacement of 0.04 inches per minute. Shearing was continued until the residual friction angle/adhesion values were well defined.

# 3.0 CLOSING REMARKS

We appreciate the opportunity to be of service to Entact. Should you have any questions or need further assistance, please do not hesitate to contact me at 1-800-692-TEST.

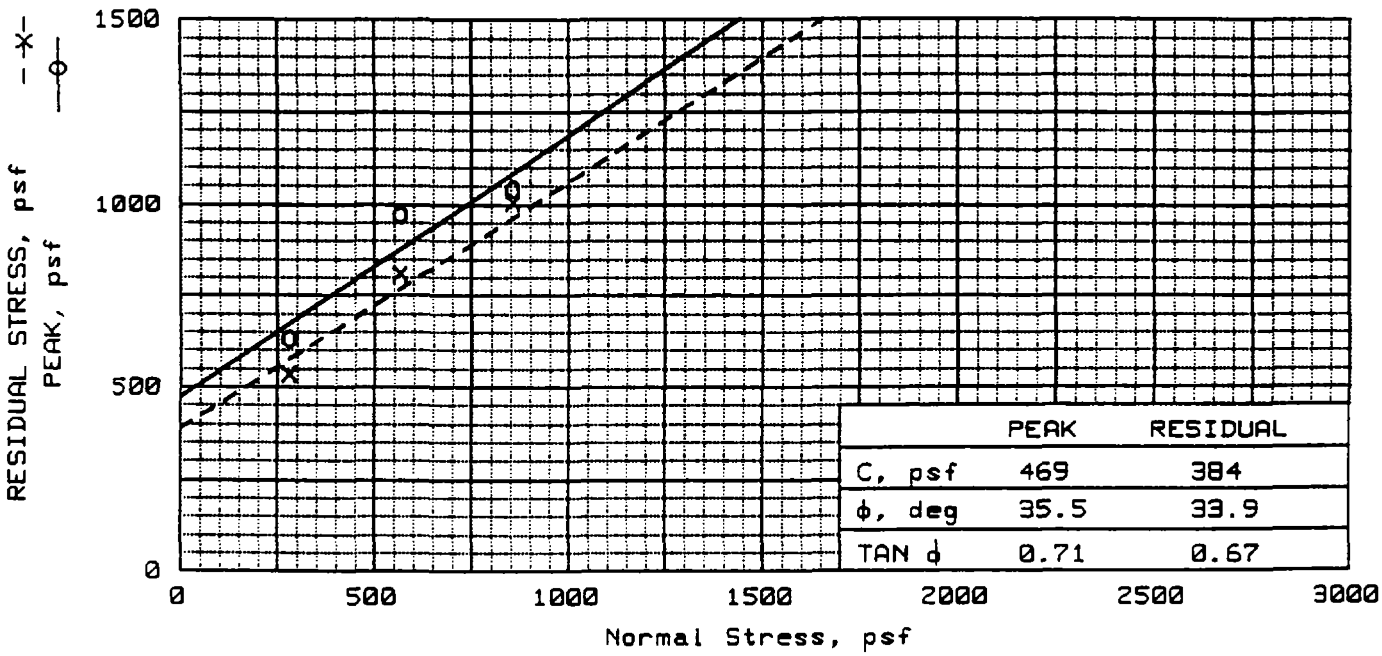
Very truly yours,

Larry L. McMichael

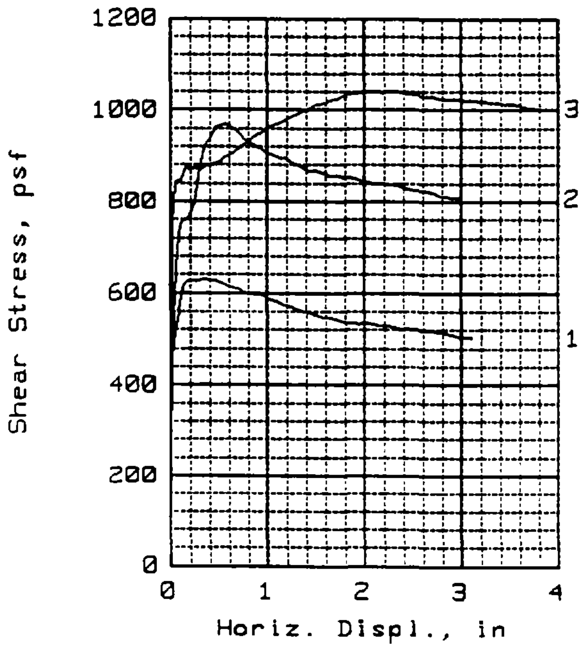
Larry L. McMichael
Vice President

LLM/dc
F:geosy/conform/EI1300.003

HTS, INC. Consultants




| | PEAK | RESIDUAL |
|---|---|---|
| C, psf | 469 | 384 |
| $\phi$, deg | 35.5 | 33.9 |
| TAN $\phi$ | 0.71 | 0.67 |




| SPECIMEN NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 18.7 | 18.7 | 18.7 |
| | DRY DENSITY, pcf | 99.5 | 99.5 | 99.5 |
| | SATURATION, % | 74.7 | 31.7 | 31.7 |
| | VOID RATIO | 0.663 | 15.635 | 15.635 |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | 4.05 | 4.05 | 4.05 |
| AT TEST | WATER CONTENT, % | 28.8 | 28.7 | 28.8 |
| | DRY DENSITY, pcf | 99.5 | 99.5 | 99.5 |
| | SATURATION, % | 115.0 | 48.7 | 48.9 |
| | VOID RATIO | 0.663 | 15.635 | 15.635 |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | 4.05 | 4.05 | 4.05 |
| NORMAL STRESS, psf | | 288 | 576 | 864 |
| PEAK, psf | | 630 | 969 | 1041 |
| DISPLACEMENT, in | | 0.33 | 0.58 | 2.25 |
| RESIDUAL STRESS, psf | | 534 | 808 | 1004 |
| DISPLACEMENT, in | | 2.00 | 2.90 | 3.75 |
| Strain rate, in/min | | 0.0400 | 0.0400 | 0.0400 |

SAMPLE TYPE: ASTM D 5321
DESCRIPTION: INTERFACE/FRICTION
SAMPLE SATURATED FOR 1 DAY

SPECIFIC GRAVITY= 2.65
REMARKS: SOIL AGAINST (OVER)
GEOGRID

CLIENT: ENTACT

PROJECT:

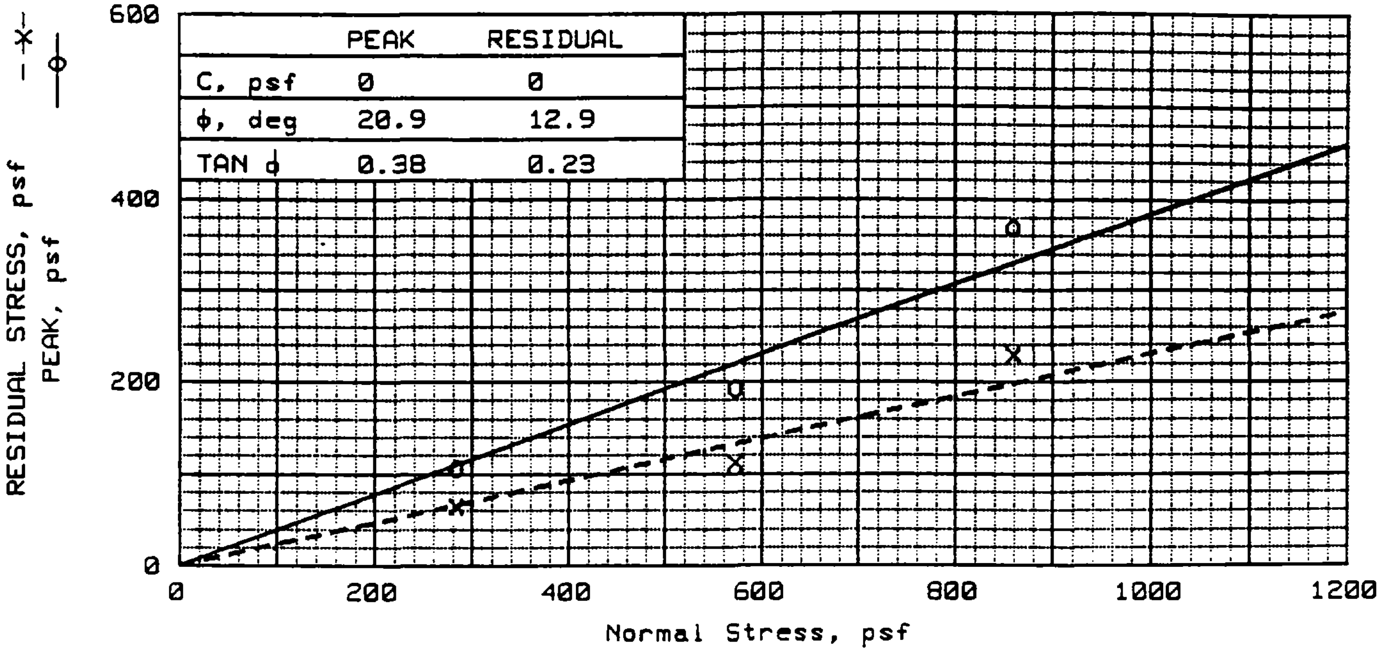
SAMPLE LOCATION:

PROJ. NO.: E1300.003 DATE: 07/15/99

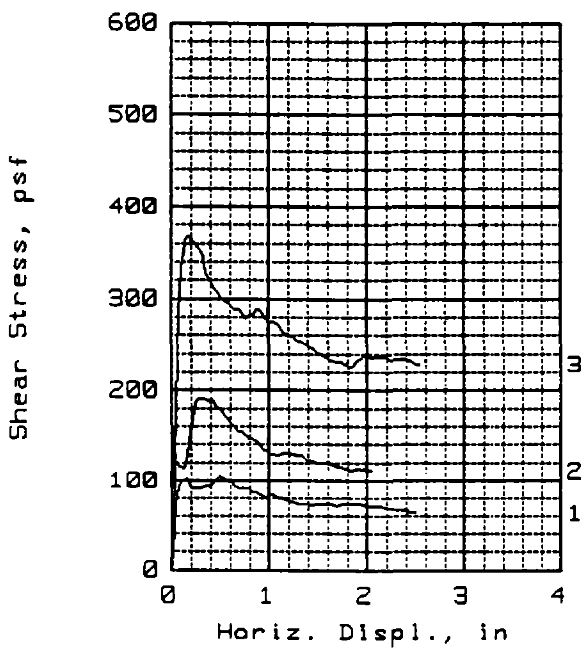
DIRECT SHEAR TEST REPORT

Fig. No.: 1

HTS, INC.
Consultants




| | PEAK | RESIDUAL |
|---|---|---|
| C, psf | 0 | 0 |
| φ, deg | 20.9 | 12.9 |
| TAN φ | 0.38 | 0.23 |




| SPECIMEN NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | N/A | N/A | N/A |
| | SATURATION, % | | | |
| | VOID RATIO | | | |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | N/A | N/A | N/A |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | N/A | N/A | N/A |
| | SATURATION, % | | | |
| | VOID RATIO | | | |
| | SIDE LENGTH, in | N/A | N/A | N/A |
| | HEIGHT, in | N/A | N/A | N/A |
| NORMAL STRESS, psf | | 288 | 576 | 864 |
| PEAK, psf | | 105 | 191 | 368 |
| DISPLACEMENT, in | | 0.50 | 0.28 | 0.18 |
| RESIDUAL STRESS, psf | | 64 | 111 | 229 |
| DISPLACEMENT, in | | 2.50 | 2.05 | 2.55 |
| Strain rate, in/min | | 0.0400 | 0.0400 | 0.0400 |

SAMPLE TYPE: ASTM D 5321
DESCRIPTION: INTERFACE/FRICTION
SAMPLE SATURATED FOR 1 DAY

SPECIFIC GRAVITY=
REMARKS: GEOGRID AGAINST (OVER)
GEOCOMPOSITE

Fig. No.: 2

CLIENT: ENTACT

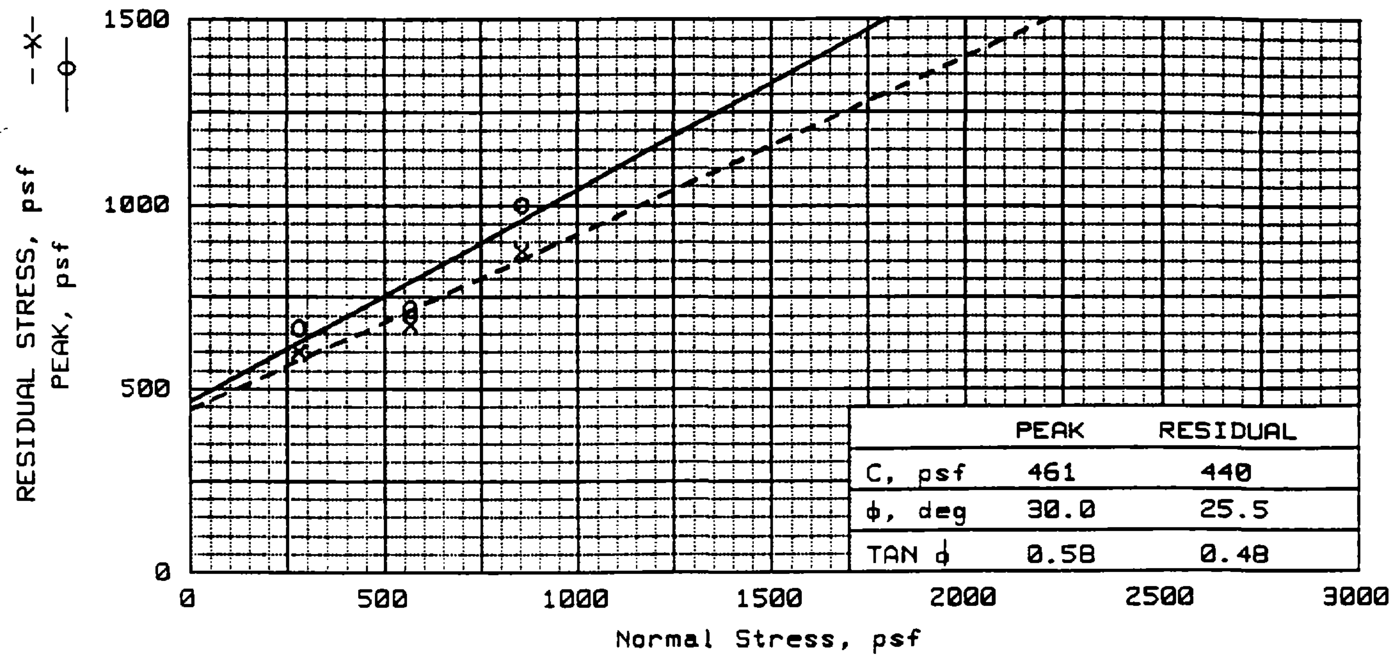
PROJECT:

SAMPLE LOCATION:

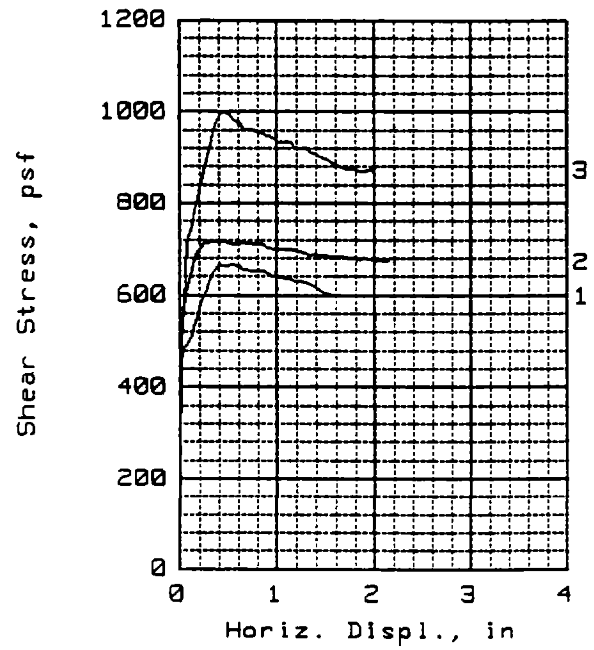
PROJ. NO.: E1300.003 DATE: 06/29/99

DIRECT SHEAR TEST REPORT

HTS, INC. Consultants




| | PEAK | RESIDUAL |
|---|---|---|
| C, psf | 461 | 440 |
| $\phi$, deg | 30.0 | 25.5 |
| TAN $\phi$ | 0.58 | 0.48 |




| | SPECIMEN NO.: | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | N/A | N/A | N/A |
| | SATURATION, % | | | |
| | VOID RATIO | | | |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | N/A | N/A | N/A |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | N/A | N/A | N/A |
| | SATURATION, % | | | |
| | VOID RATIO | | | |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | N/A | N/A | N/A |
| | NORMAL STRESS, psf | 288 | 576 | 864 |
| | PEAK, psf | 665 | 717 | 997 |
| | DISPLACEMENT, in | 0.43 | 0.43 | 0.45 |
| | RESIDUAL STRESS, psf | 598 | 673 | 873 |
| | DISPLACEMENT, in | 2.00 | 2.15 | 2.00 |
| | Strain rate, in/min | 0.0400 | | 0.0400 |

SAMPLE TYPE: ASTM D 5321
DESCRIPTION: INTERFACE/FRICTION
SAMPLE SATURATED FOR 1 DAY

SPECIFIC GRAVITY=
REMARKS: GEOCOMPOSITE AGAINST
(OVER) TEXTURED GEOMEMBRANE

Fig. No.: 3

CLIENT: ENTACT

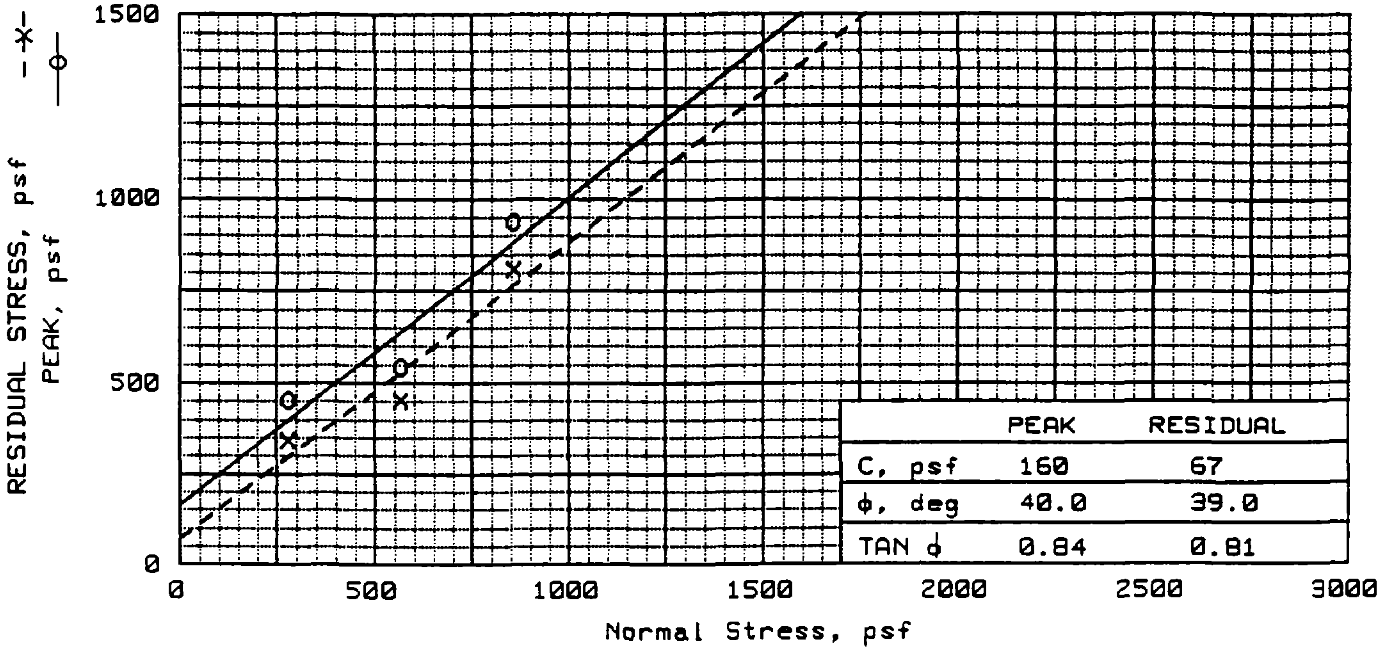
PROJECT:

SAMPLE LOCATION:

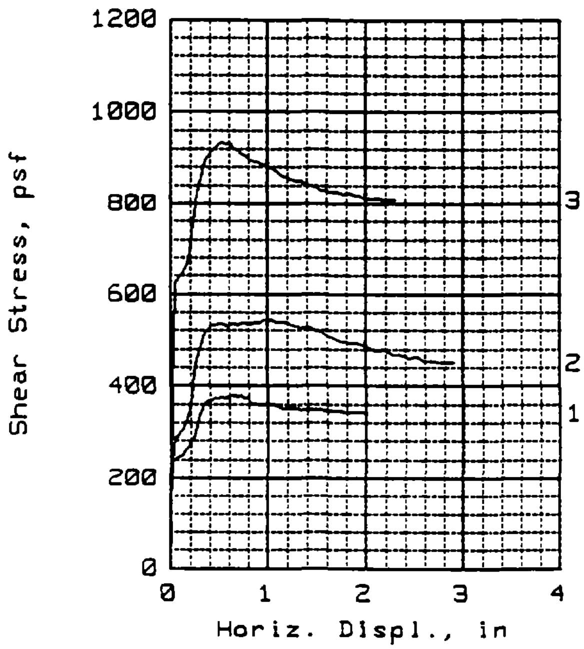
PROJ. NO.: E1300.003 DATE: 07/16/99

DIRECT SHEAR TEST REPORT

HTS, INC. Consultants




| | PEAK | RESIDUAL |
|---|---|---|
| C, psf | 160 | 67 |
| $\phi$, deg | 40.0 | 39.0 |
| TAN $\phi$ | 0.84 | 0.81 |




| | SPECIMEN NO.: | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | N/A | N/A | N/A |
| | SATURATION, % | | | |
| | VOID RATIO | | | |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | N/A | N/A | N/A |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | N/A | N/A | N/A |
| | SATURATION, % | | | |
| | VOID RATIO | | | |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | N/A | N/A | N/A |
| | NORMAL STRESS, psf | 288 | 576 | 864 |
| | PEAK, psf | 452 | 542 | 935 |
| | DISPLACEMENT, in | 0.00 | 0.98 | 0.53 |
| | RESIDUAL STRESS, psf | 342 | 452 | 809 |
| | DISPLACEMENT, in | 2.00 | 2.90 | 2.30 |
| | Strain rate, in/min | 0.0400 | 0.0400 | 0.0400 |

SAMPLE TYPE: ASTM D 5321
DESCRIPTION: INTERFACE/FRICTION
SAMPLE SATURATED FOR 1 DAY

SPECIFIC GRAVITY=
REMARKS: TEXTURED GEOMEMBRANE
AGAINST (OVER) GCL

Fig. No.: 4

CLIENT: ENTACT

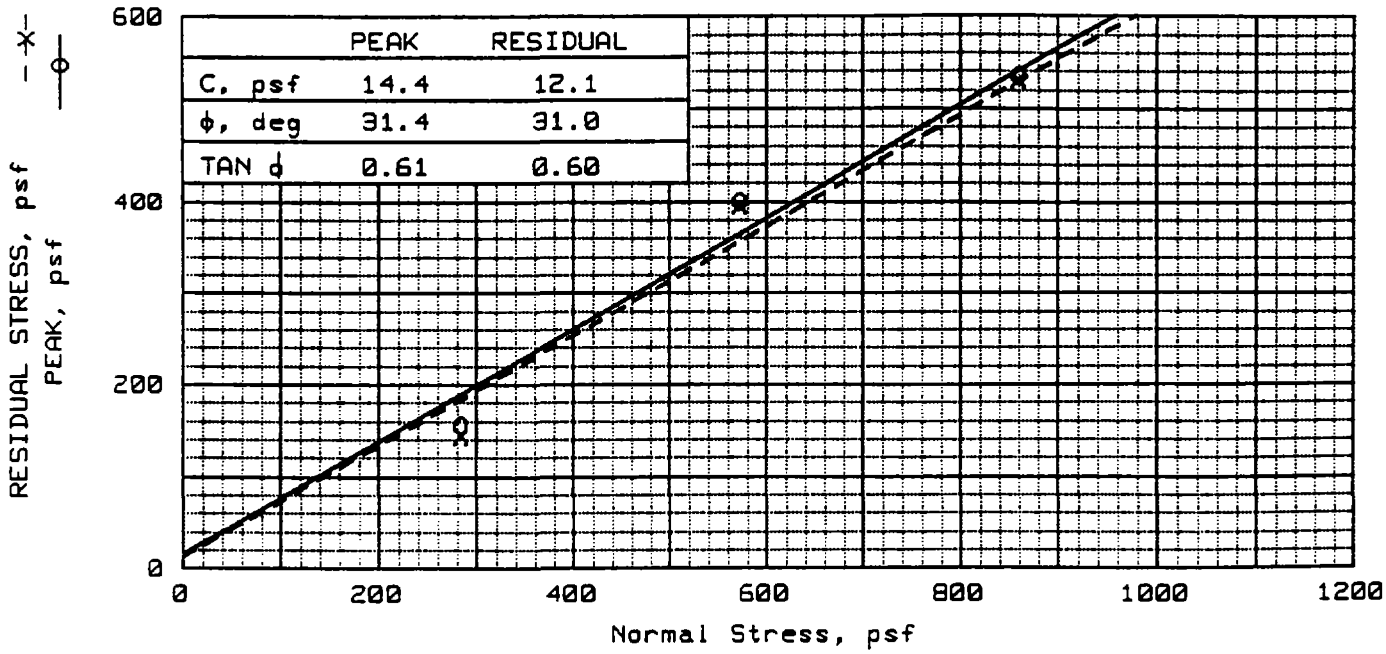
PROJECT:

SAMPLE LOCATION:

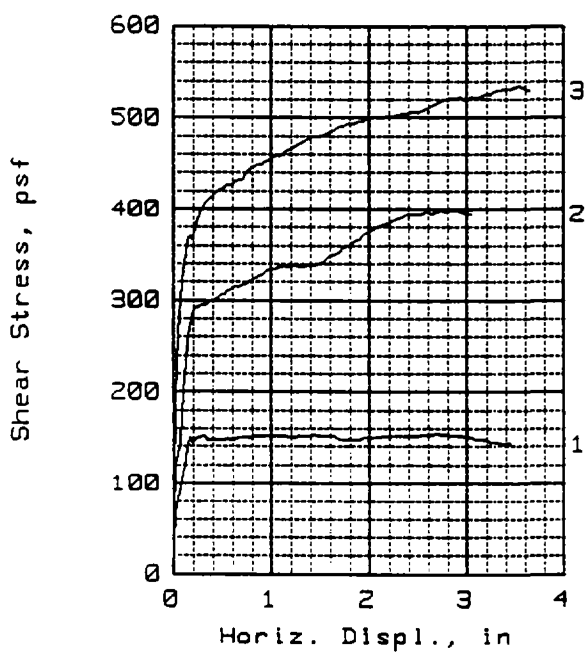
PROJ. NO.: E1300.003 DATE: 07/17/99

DIRECT SHEAR TEST REPORT

HTS, INC. Consultants




| | PEAK | RESIDUAL |
|---|---|---|
| C, psf | 14.4 | 12.1 |
| ϕ, deg | 31.4 | 31.0 |
| TAN ϕ | 0.61 | 0.60 |




| SPECIMEN NO.: | | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 20.3 | 20.3 | 20.3 |
| | DRY DENSITY, pcf | 93.2 | 93.2 | 93.2 |
| | SATURATION, % | 71.3 | 71.3 | 71.3 |
| | VOID RATIO | 0.741 | 0.741 | 0.741 |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | 4.05 | 4.05 | 4.05 |
| AT TEST | WATER CONTENT, % | 0.0 | 0.0 | 0.0 |
| | DRY DENSITY, pcf | 93.2 | 93.2 | 93.2 |
| | SATURATION, % | 0.0 | 0.0 | 0.0 |
| | VOID RATIO | 0.741 | 0.741 | 0.741 |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | 4.05 | 4.05 | 4.05 |
| NORMAL STRESS, psf | | 288 | 576 | 864 |
| PEAK, psf | | 155 | 399 | 535 |
| DISPLACEMENT, in | | 2.70 | 2.75 | 3.55 |
| RESIDUAL STRESS, psf | | 143 | 395 | 530 |
| DISPLACEMENT, in | | 3.45 | 3.05 | 3.65 |
| Strain rate, in/min | | 0.0400 | 0.0400 | 0.0400 |

SAMPLE TYPE: ASTM D 5321
DESCRIPTION: INTERFACE/FRICTION
SAMPLE SATURATED FOR 1 DAY

SPECIFIC GRAVITY= 2.6
REMARKS: GCL AGAINST (OVER)
SOIL

CLIENT: ENTACT

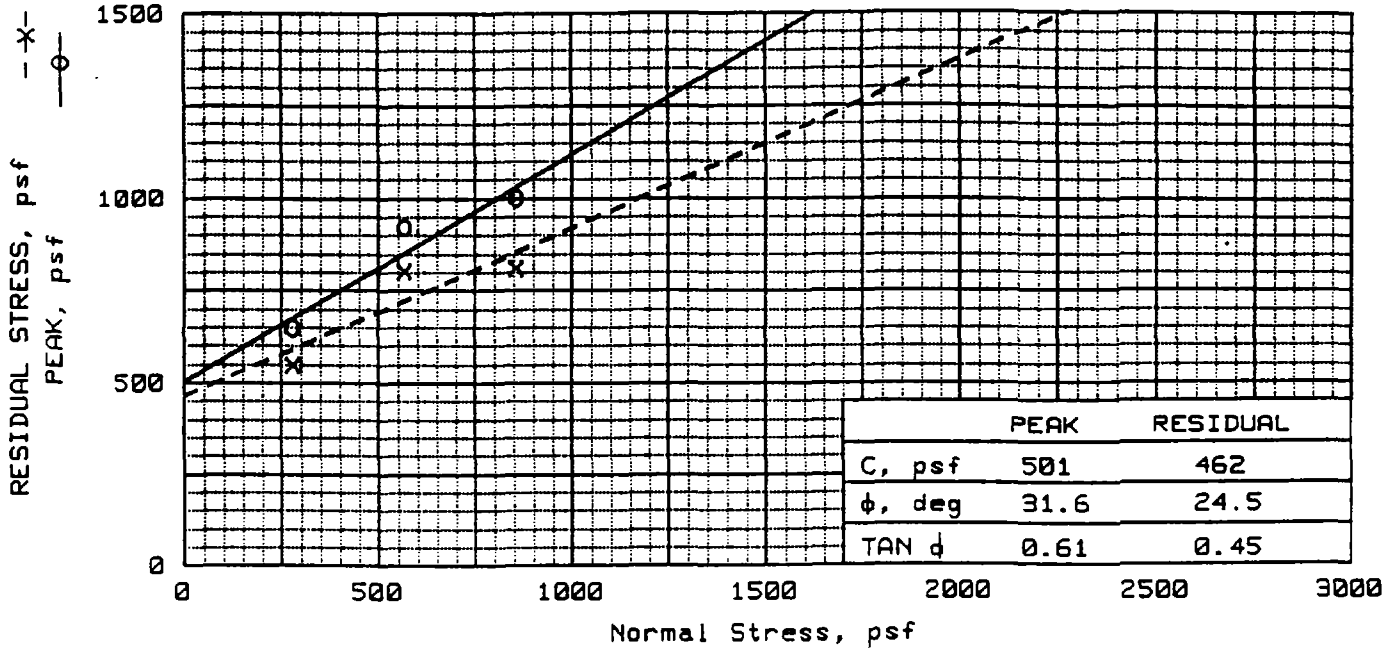
PROJECT:

SAMPLE LOCATION:

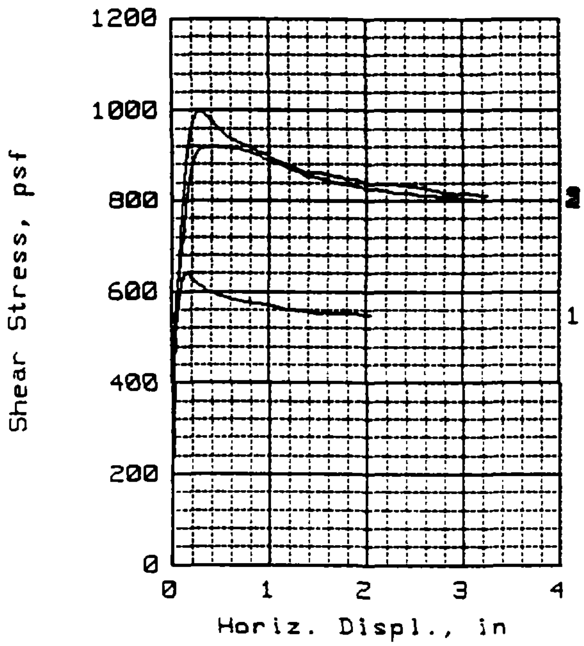
PROJ. NO.: E1300.003 DATE: 07/19/99

DIRECT SHEAR TEST REPORT

Fig. No.: 5




| | PEAK | RESIDUAL |
|---|---|---|
| C, psf | 501 | 462 |
| ϕ, deg | 31.6 | 24.5 |
| TAN ϕ | 0.61 | 0.45 |




| | SPECIMEN NO.: | 1 | 2 | 3 |
|---|---|---|---|---|
| INITIAL | WATER CONTENT, % | 18.7 | 18.7 | 18.7 |
| | DRY DENSITY, pcf | 99.5 | 99.5 | 99.5 |
| | SATURATION, % | 76.9 | 76.9 | 76.9 |
| | VOID RATIO | 0.632 | 0.632 | 0.632 |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | 4.05 | 4.05 | 4.05 |
| AT TEST | WATER CONTENT, % | 23.0 | 23.0 | 23.0 |
| | DRY DENSITY, pcf | 99.5 | 99.5 | 99.5 |
| | SATURATION, % | 94.6 | 94.6 | 94.6 |
| | VOID RATIO | 0.632 | 0.632 | 0.632 |
| | SIDE LENGTH, in | 12.00 | 12.00 | 12.00 |
| | HEIGHT, in | 4.05 | 4.05 | 4.05 |
| | NORMAL STRESS, psf | 288 | 576 | 864 |
| | PEAK, psf | 645 | 920 | 999 |
| | DISPLACEMENT, in | 0.18 | 0.40 | 0.28 |
| | RESIDUAL STRESS, psf | 548 | 802 | 810 |
| | DISPLACEMENT, in | 2.05 | 3.10 | 3.25 |
| | Strain rate, in/min | 0.0400 | 0.0400 | 0.0400 |

SAMPLE TYPE: ASTM D 5321
DESCRIPTION: INTERFACE/FRICTION
SAMPLE SATURATED FOR 1 DAY

SPECIFIC GRAVITY= 2.6
REMARKS: SOIL AGAINST (OVER)
GEOCOMPOSITE

CLIENT: ENTACT

PROJECT:

SAMPLE LOCATION:

PROJ. NO.: E1300.003 DATE: 07/14/99

DIRECT SHEAR TEST REPORT

Fig. No.: 6

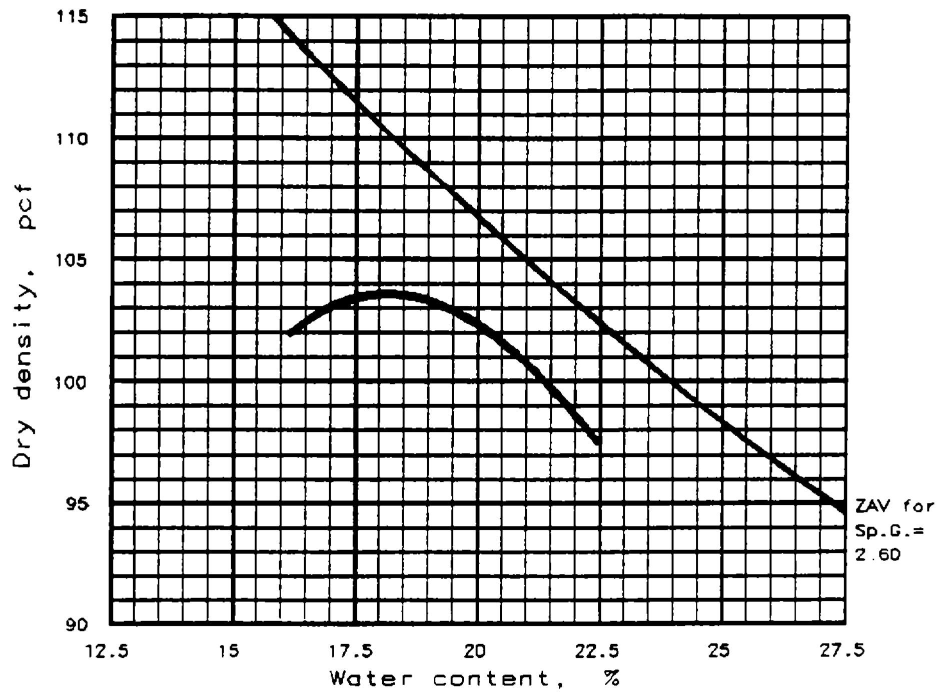
HTS, INC. Consultants

HTS. INC.
Consultants

TO:

DATE: 7-12-1999
REPORT NO.: 1111
PROJECT: Entact
Granite City, IL

## PROCTOR TEST REPORT




Test specification: ASTM D 1557-91 Method A, Modified
Oversize correction applied to final results

| CURVE NO. | TEST RESULTS | | PROCEDURE | RAMMER TYPE | LL | PL | PI |
|---|---|---|---|---|---|---|---|
| | MAXIMUM DRY DENSITY (PCF) | OPTIMUM WATER CONTENT (%) | ☒ WET ☐ DRY | ☐ MANUAL ☒ MECHANICAL | | | |
| 1 | 103.6 | 18.1 | | | | | |

| SAMPLE LOCATION | MATERIAL DESCRIPTION |
|---|---|
| 2245 Adams St. | Dark Gray Sandy Clay |

Remarks: Test # 446
(Bottom Soil)

Copies: 1-Above

HTS, INC. consultants

NOTE: test results comply with project specifications except those marked *

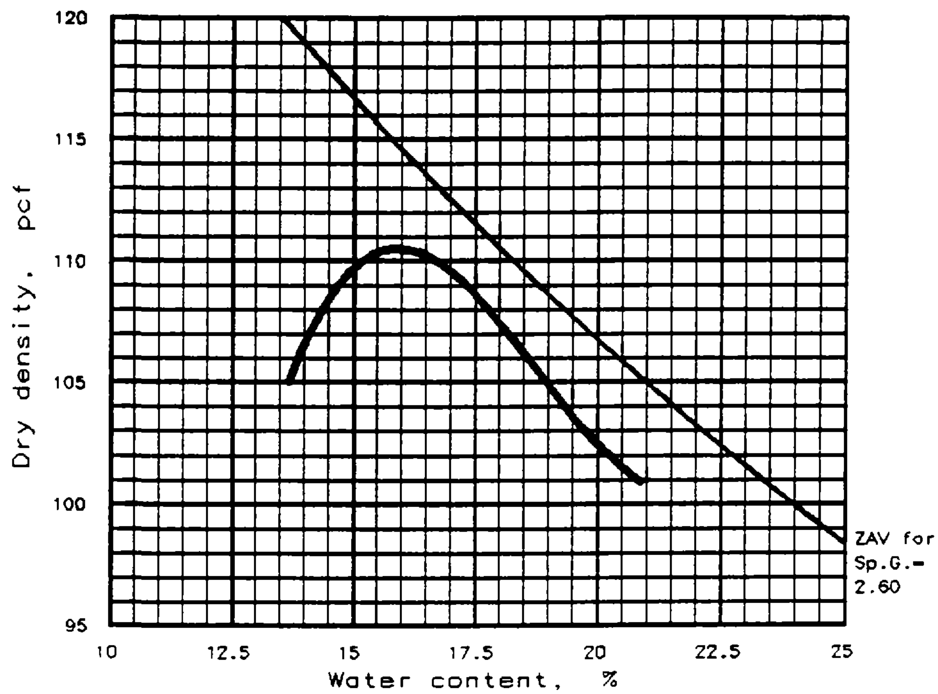
THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF HTS, INC.

HTS. INC.
Consultants

TO: Entact
2245 Adams St.
Granite City, IL
Attn: Mr. Don Rest

DATE: 6-29-1999
REPORT NO.: 1111
PROJECT: HTS Project # E1300
ID # 142

## PROCTOR TEST REPORT




Test specification: ASTM D 1557-91 Method A, Modified
Oversize correction applied to final results

| CURVE NO. | TEST RESULTS: MAXIMUM DRY DENSITY (PCF) | TEST RESULTS: OPTIMUM WATER CONTENT (%) | PROCEDURE | RAMMER TYPE | LL | PL | PI |
|---|---|---|---|---|---|---|---|
| 1 | 110.5 | 15.9 | ☒ WET ☐ DRY | ☐ MANUAL ☒ MECHANICAL | | | |

| SAMPLE LOCATION | MATERIAL DESCRIPTION |
|---|---|
| | Brown Lean Clay |

Remarks: Test # 421 / ID # 2795
(Soil Cover)

Copies: 1-Above

HTS, INC. consultants

NOTE: test results comply with project specifications except those marked *

THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE APPROVAL OF HTS, INC.

P.O. BOX 10348 · HOUSTON, TEXAS 77206 · 713 / 692-8373

HTS, INC.
Consultants

416 PICKERING STREET • HOUSTON, TEXAS 77091
713/692-8373 • 800/692-TEST • FAX 713/692-8502

June 3, 1999

Entact
2245 Adams ST
Granite City, IL 62040

Attn: Mr Dan Rest
Re:
Peel and Shear Tests of Seams
60 Mil textured HDPE
HTS Report No. E1300.002.doc

| TEST PARAMETERS AND LABORATORY CONDITIONS | | | |
|---|---|---|---|
| Sample Type | ASTM | Sample Width (in) | 1 |
| Humidity (%) | 50 | Spec Gauge Length (in) | 1 |
| Temperature (deg. F) | 73 | Grip Distance (in) | 1 |
| Operator Name: | K. Phouangsavanh | Crosshead Speed (in/min) | 2 |

Please find attached peel and shear reports of 4 samples delivered to our laboratory on 06/03/99. Peel and shear tests were performed in accordance with Test Method ASTM D 4437. The test results are summarized on the following pages

| SAMPLE I.D. | NOMINAL THICKNESS | SAMPLE I.D. | NOMINAL THICKNESS |
|---|---|---|---|
| LDS-1 | 60 | | |
| LDS-2 | 60 | | |
| LDS-3 | 60 | | |
| LDS-4 | 60 | | |

Very truly yours,

Larry L. McMichael

Larry L. McMichael
Vice President

| | | PEEL | | | SHEAR | | |
|---|---|---|---|---|---|---|---|
| **Sample** | **Spec. No.** | **lb / in.** | **% Peel** | **Break Code** | **lb / in.** | **% Peel** | **Break Code** |
| LDS-1 | 1 | 134 | | FTB/SE1 | 175 | | FTB/BRK |
| | 2 | 133 | | FTB/SE1 | 178 | | FTB/BRK |
| | 3 | 139 | | FTB/SE1 | 177 | | FTB/BRK |
| | 4 | 137 | | FTB/SE1 | 177 | | FTB/BRK |
| | 5 | 134 | | FTB/SE1 | 175 | | FTB/BRK |
| | AVG. | 135 | | | 176 | | |
| LDS-2 | 1 | 152 | | FTB/SE1 | 187 | | FTB/BRK |
| | 2 | 150 | | FTB/SE1 | 188 | | FTB/BRK |
| | 3 | 149 | | FTB/SE1 | 185 | | FTB/BRK |
| | 4 | 157 | | FTB/SE1 | 188 | | FTB/BRK |
| | 5 | 152 | | FTB/SE1 | 186 | | FTB/BRK |
| | AVG. | 152 | | | 187 | | |
| LDS-3 | 1 | 144 | | FTB/SE1 | 182 | | FTB/BRK |
| | 2 | 144 | | FTB/SE1 | 180 | | FTB/BRK |
| | 3 | 142 | | FTB/SE1 | 177 | | FTB/BRK |
| | 4 | 138 | | FTB/SE1 | 181 | | FTB/BRK |
| | 5 | 155 | | FTB/SE1 | 179 | | FTB/BRK |
| | AVG. | 145 | | | 180 | | |
| LDS-4 | 1 | 147 | | FTB/SE1 | 191 | | FTB/BRK |
| | 2 | 149 | | FTB/SE1 | 184 | | FTB/BRK |
| | 3 | 150 | | FTB/SE1 | 187 | | FTB/BRK |
| | 4 | 154 | | FTB/SE1 | 180 | | FTB/BRK |
| | 5 | 145 | | FTB/SE1 | 184 | | FTB/BRK |
| | AVG. | 149 | | | 185 | | |



HTS, INC. Consultants

HTS, INC.
Consultants

August 2, 1999

Entact
2245 Adams Street
Granite City, IL 62040

Attn: Mr. Dan Rest

Re:
Peel and Shear Tests of Seams
40 mil textured LLDPE
HTS Report No. E1300.004.doc

| TEST PARAMETERS AND LABORATORY CONDITIONS | | | |
|---|---|---|---|
| Sample Type | ASTM | Sample Width (in) | 1 |
| Humidity (%) | 50 | Spec Gauge Length (in) | 1 |
| Temperature (deg. F) | 73 | Grip Distance (in) | 1 |
| Operator Name: | K. Phouangsavanh | Crosshead Speed (in/min) | 20 |

Please find attached peel and shear reports of 3 samples delivered to our laboratory on 8/2/99. Peel and shear tests were performed in accordance with Test Method ASTM D 4437. The test results are summarized on the following pages:

| SAMPLE I.D. | NOMINAL THICKNESS | SAMPLE I.D. | NOMINAL THICKNESS |
|---|---|---|---|
| CDS-1 | 40 | | |
| CDS-2 | 40 | | |
| CDS-3 | 40 | | |

Very truly yours,

Larry L. McMichael

Larry L. McMichael KP
President



P.O. BOX 10348 • HOUSTON, TEXAS 77206 • 713/692-8373

| | | PEEL | | | | | | SHEAR | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | WELD A | | | WELD B | | | | | |
| Sample | Spec. No. | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code |
| CDS-1 | 1 | 96 | | FTB/SE1 | 100 | | FTB/SE1 | 104 | | FTB/BRK |
| | 2 | 88 | | FTB/SE1 | 82 | | FTB/SE1 | 104 | | FTB/BRK |
| | 3 | 94 | | FTB/SE1 | 96 | | FTB/SE1 | 105 | | FTB/BRK |
| | 4 | 98 | | FTB/SE1 | 89 | | FTB/SE1 | 104 | | FTB/BRK |
| | 5 | 95 | | FTB/SE1 | 95 | | FTB/SE1 | 103 | | FTB/BRK |
| | AVG. | 94 | | | 92 | | | 104 | | |
| CDS-2 | 1 | 98 | | FTB/SE1 | 93 | | FTB/SE1 | 101 | | FTB/BRK |
| | 2 | 94 | | FTB/SE1 | 98 | | FTB/SE1 | 104 | | FTB/BRK |
| | 3 | 98 | | FTB/SE1 | 95 | | FTB/SE1 | 103 | | FTB/BRK |
| | 4 | 96 | | FTB/SE1 | 93 | | FTB/SE1 | 101 | | FTB/BRK |
| | 5 | 93 | | FTB/SE1 | 98 | | FTB/SE1 | 102 | | FTB/BRK |
| | AVG. | 96 | | | 95 | | | 102 | | |
| CDS-3 | 1 | 98 | | FTB/SE1 | 97 | | FTB/SE1 | 105 | | FTB/BRK |
| | 2 | 93 | | FTB/SE1 | 95 | | FTB/SE1 | 104 | | FTB/BRK |
| | 3 | 99 | | FTB/SE1 | 99 | | FTB/SE1 | 103 | | FTB/BRK |
| | 4 | 97 | | FTB/SE1 | 96 | | FTB/SE1 | 105 | | FTB/BRK |
| | 5 | 98 | | FTB/SE1 | 96 | | FTB/SE1 | 103 | | FTB/BRK |
| | AVG. | 97 | | | 97 | | | 104 | | |

HTS, INC.
Consultants

August 3, 1999

Entact
2245 Adams Street
Granite City, IL 62040

Attn: Mr. Dan Rest

Re:
Peel and Shear Tests of Seams
40 mil textured LLDPE
HTS Report No. E1300.005.doc

| TEST PARAMETERS AND LABORATORY CONDITIONS | | | |
|---|---|---|---|
| Sample Type | ASTM | Sample Width (in) | 1 |
| Humidity (%) | 50 | Spec Gauge Length (in) | 1 |
| Temperature (deg. F) | 73 | Grip Distance (in) | 1 |
| Operator Name: | K. Phouangsavanh | Crosshead Speed (in/min) | 20 |

Please find attached peel and shear reports of 7 samples delivered to our laboratory on 8/3/99. Peel and shear tests were performed in accordance with Test Method ASTM D 4437. The test results are summarized on the following pages:

| SAMPLE I.D. | NOMINAL THICKNESS | SAMPLE I.D. | NOMINAL THICKNESS |
|---|---|---|---|
| CDS-4 | 40 | | |
| CDS-5 | 40 | | |
| CDS-6 | 40 | | |
| CDS-7 | 40 | | |
| CDS-8 | 40 | | |
| CDS-9 | 40 | | |
| CDS-10 | 40 | | |

Very truly yours,

Larry L. McMichael

Larry L. McMichael KP
e President



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| | | PEEL | | | | | | SHEAR | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | WELD A | | | WELD B | | | | | |
| Sample | Spec. No. | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code |
| CDS-4 | 1 | 93 | | FTB/SE1 | 91 | | FTB/SE1 | 96 | | FTB/BRK |
| | 2 | 97 | | FTB/SE1 | 93 | | FTB/SE1 | 90 | | FTB/BRK |
| | 3 | 92 | | FTB/SE1 | 93 | | FTB/SE1 | 90 | | FTB/BRK |
| | 4 | 93 | | FTB/SE1 | 92 | | FTB/SE1 | 91 | | FTB/BRK |
| | 5 | 93 | | FTB/SE1 | 91 | | FTB/SE1 | 90 | | FTB/BRK |
| | AVG. | 94 | | | 92 | | | 91 | | |
| CDS-5 | 1 | 96 | | FTB/SE1 | 96 | | FTB/SE1 | 100 | | FTB/BRK |
| | 2 | 87 | | FTB/SE1 | 94 | | FTB/SE1 | 98 | | FTB/BRK |
| | 3 | 99 | | FTB/SE1 | 95 | | FTB/SE1 | 96 | | FTB/BRK |
| | 4 | 94 | | FTB/SE1 | 93 | | FTB/SE1 | 102 | | FTB/BRK |
| | 5 | 99 | | FTB/SE1 | 95 | | FTB/SE1 | 93 | | FTB/BRK |
| | AVG. | 95 | | | 95 | | | 98 | | |
| CDS-6 | 1 | 93 | | FTB/SE1 | 98 | | FTB/SE1 | 96 | | FTB/BRK |
| | 2 | 90 | | FTB/SE1 | 90 | | FTB/SE1 | 92 | | FTB/BRK |
| | 3 | 93 | | FTB/SE1 | 91 | | FTB/SE1 | 96 | | FTB/BRK |
| | 4 | 92 | | FTB/SE1 | 91 | | FTB/SE1 | 95 | | FTB/BRK |
| | 5 | 87 | | FTB/SE1 | 92 | | FTB/SE1 | 96 | | FTB/BRK |
| | AVG. | 91 | | | 92 | | | 95 | | |
| CDS-7 | 1 | 101 | | FTB/SE1 | 94 | | FTB/SE1 | 103 | | FTB/BRK |
| | 2 | 93 | | FTB/SE1 | 89 | | FTB/SE1 | 101 | | FTB/BRK |
| | 3 | 87 | | FTB/SE1 | 93 | | FTB/SE1 | 101 | | FTB/BRK |
| | 4 | 93 | | FTB/SE1 | 86 | | FTB/SE1 | 101 | | FTB/BRK |
| | 5 | 99 | | FTB/SE1 | 94 | | FTB/SE1 | 101 | | FTB/BRK |
| | AVG. | 95 | | | 91 | | | 101 | | |
| CDS-8 | 1 | 92 | | FTB/SE1 | 88 | | FTB/SE1 | 101 | | FTB/BRK |
| | 2 | 89 | | FTB/SE1 | 93 | | FTB/SE1 | 85 | | FTB/BRK |
| | 3 | 92 | | FTB/SE1 | 90 | | FTB/SE1 | 86 | | FTB/BRK |
| | 4 | 90 | | FTB/SE1 | 85 | | FTB/SE1 | 99 | | FTB/BRK |
| | 5 | 82 | | FTB/SE1 | 92 | | FTB/SE1 | 94 | | FTB/BRK |
| | AVG. | 89 | | | 90 | | | 93 | | |



HTS, INC. Consultants

| | | PEEL | | | | | | SHEAR | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | WELD A | | | WELD B | | | | | |
| Sample | Spec. No. | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code |
| CDS-9 | 1 | 86 | | FTB/SE1 | 77 | | FTB/SE1 | 96 | | FTB/BRK |
| | 2 | 88 | | FTB/SE1 | 77 | | FTB/SE1 | 93 | | FTB/BRK |
| | 3 | 82 | | FTB/SE1 | 79 | | FTB/SE1 | 92 | | FTB/BRK |
| | 4 | 83 | | FTB/SE1 | 77 | | FTB/SE1 | 88 | | FTB/BRK |
| | 5 | 84 | | FTB/SE1 | 79 | | FTB/SE1 | 90 | | FTB/BRK |
| | AVG. | 85 | | | 78 | | | 92 | | |
| CDS-10 | 1 | 104 | | FTB/SE1 | 106 | | FTB/SE1 | 112 | | FTB/BRK |
| | 2 | 104 | | FTB/SE1 | 98 | | FTB/SE1 | 114 | | FTB/BRK |
| | 3 | 106 | | FTB/SE1 | 101 | | FTB/SE1 | 112 | | FTB/BRK |
| | 4 | 102 | | FTB/SE1 | 101 | | FTB/SE1 | 115 | | FTB/BRK |
| | 5 | 109 | | FTB/SE1 | 100 | | FTB/SE1 | 112 | | FTB/BRK |
| | AVG. | 105 | | | 101 | | | 113 | | |

HTS, INC.
Consultants

August 4, 1999

Entact
2245 Adams Street
Granite City, IL 62040

Attn: Mr. Dan Rest

Re:
Peel and Shear Tests of Seams
40 mil textured LLDPE
HTS Report No. E1300.006.doc

| TEST PARAMETERS AND LABORATORY CONDITIONS | | | |
|---|---|---|---|
| Sample Type | ASTM | Sample Width (in) | 1 |
| Humidity (%) | 50 | Spec Gauge Length (in) | 1 |
| Temperature (deg. F) | 73 | Grip Distance (in) | 1 |
| Operator Name: | K. Phouangsavanh | Crosshead Speed (in/min) | 20 |

Please find attached peel and shear reports of 5 samples delivered to our laboratory on 8/4/99. Peel and shear tests were performed in accordance with Test Method ASTM D 4437. The test results are summarized on the following pages:

| SAMPLE I.D. | NOMINAL THICKNESS | SAMPLE I.D. | NOMINAL THICKNESS |
|---|---|---|---|
| CDS-11 | 40 | | |
| CDS-12 | 40 | | |
| CDS-13 | 40 | | |
| CDS-14 | 40 | | |
| CDS-15 | 40 | | |

Very truly yours,

Larry L. McMichael

Larry L. McMichael KP
Vice President



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| | | PEEL | | | | | | SHEAR | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | WELD A | | | WELD B | | | | | |
| Sample | Spec. No. | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code |
| CDS-11 | 1 | 102 | | FTB/SE1 | 109 | | FTB/SE1 | 114 | | FTB/BRK |
| | 2 | 93 | | FTB/SE1 | 105 | | FTB/SE1 | 114 | | FTB/BRK |
| | 3 | 100 | | FTB/SE1 | 97 | | FTB/SE1 | 113 | | FTB/BRK |
| | 4 | 99 | | FTB/SE1 | 91 | | FTB/SE1 | 116 | | FTB/BRK |
| | 5 | 101 | | FTB/SE1 | 103 | | FTB/SE1 | 118 | | FTB/BRK |
| | AVG. | 99 | | | 101 | | | 115 | | |
| CDS-12 | 1 | 98 | | FTB/SE1 | 113 | | FTB/SE1 | 112 | | FTB/BRK |
| | 2 | 103 | | FTB/SE1 | 111 | | FTB/SE1 | 120 | | FTB/BRK |
| | 3 | 108 | | FTB/SE1 | 110 | | FTB/SE1 | 118 | | FTB/BRK |
| | 4 | 104 | | FTB/SE1 | 93 | | FTB/SE1 | 117 | | FTB/BRK |
| | 5 | 106 | | FTB/SE1 | 96 | | FTB/SE1 | 119 | | FTB/BRK |
| | AVG. | 104 | | | 105 | | | 117 | | |
| CDS-13 | 1 | 99 | | FTB/SE1 | 107 | | FTB/SE1 | 116 | | FTB/BRK |
| | 2 | 101 | | FTB/SE1 | 106 | | FTB/SE1 | 118 | | FTB/BRK |
| | 3 | 107 | | FTB/SE1 | 103 | | FTB/SE1 | 116 | | FTB/BRK |
| | 4 | 105 | | FTB/SE1 | 104 | | FTB/SE1 | 117 | | FTB/BRK |
| | 5 | 102 | | FTB/SE1 | 107 | | FTB/SE1 | 116 | | FTB/BRK |
| | AVG. | 103 | | | 105 | | | 117 | | |
| CDS-14 | 1 | 106 | | FTB/SE1 | 98 | | FTB/SE1 | 117 | | FTB/BRK |
| | 2 | 102 | | FTB/SE1 | 104 | | FTB/SE1 | 116 | | FTB/BRK |
| | 3 | 102 | | FTB/SE1 | 86 | | NON-FTB/AD | 116 | | FTB/BRK |
| | 4 | 109 | | FTB/SE1 | 103 | | FTB/SE1 | 115 | | FTB/BRK |
| | 5 | 103 | | FTB/SE1 | 101 | | FTB/SE1 | 116 | | FTB/BRK |
| | AVG. | 104 | | | 98 | | | 116 | | |
| CDS-15 | 1 | 92 | | FTB/SE1 | 85 | | FTB/SE1 | 98 | | FTB/BRK |
| | 2 | 93 | | FTB/SE1 | 86 | | FTB/SE1 | 98 | | FTB/BRK |
| | 3 | 87 | | FTB/SE1 | 91 | | FTB/SE1 | 98 | | FTB/BRK |
| | 4 | 90 | | FTB/SE1 | 84 | | FTB/SE1 | 98 | | FTB/BRK |
| | 5 | 83 | | FTB/SE1 | 87 | | FTB/SE1 | 98 | | FTB/BRK |
| | AVG. | 89 | | | 87 | | | 98 | | |

HTS, INC.
Consultants

August 6, 1999

Entact
2245 Adams Street
Granite City, IL 62040

Attn: Mr. Dan Rest

Re:
Peel and Shear Tests of Seams
40 mil textured LLDPE
HTS Report No. E1300.007.doc

| TEST PARAMETERS AND LABORATORY CONDITIONS | | | |
|---|---|---|---|
| Sample Type | ASTM | Sample Width (in) | 1 |
| Humidity (%) | 50 | Spec Gauge Length (in) | 1 |
| Temperature (deg. F) | 73 | Grip Distance (in) | 1 |
| Operator Name: | K. Phouangsavanh | Crosshead Speed (in/min) | 20 |

Please find attached peel and shear reports of 3 samples delivered to our laboratory on 8/6/99. Peel and shear tests were performed in accordance with Test Method ASTM D 4437. The test results are summarized on the following pages:

| SAMPLE I.D. | NOMINAL THICKNESS | SAMPLE I.D. | NOMINAL THICKNESS |
|---|---|---|---|
| CDS-16 | 40 | | |
| CDS-17 | 40 | | |
| CDS-18 | 40 | | |

Very truly yours,

Larry L. McMichael

Larry L. McMichael
˙ ˙e President



P.O. BOX 10348 • HOUSTON, TEXAS 77206 • 713/692-8373

| | | PEEL | | | | | | SHEAR | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | WELD A | | | WELD B | | | | | |
| Sample | Spec. No. | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code | lb / in. | % Peel | Break Code |
| CDS-16 | 1 | 92 | | FTB/SE1 | 83 | | FTB/SE1 | 97 | | FTB/BRK |
| | 2 | 93 | | FTB/SE1 | 83 | | FTB/SE1 | 96 | | FTB/BRK |
| | 3 | 90 | | FTB/SE1 | 84 | | FTB/SE1 | 97 | | FTB/BRK |
| | 4 | 90 | | FTB/SE1 | 86 | | FTB/SE1 | 97 | | FTB/BRK |
| | 5 | 91 | | FTB/SE1 | 81 | | FTB/SE1 | 94 | | FTB/BRK |
| | AVG. | 91 | | | 83 | | | 96 | | |
| CDS-17 | 1 | 97 | | FTB/SE1 | 85 | | FTB/SE1 | 103 | | FTB/BRK |
| | 2 | 94 | | FTB/SE1 | 98 | | FTB/SE1 | 101 | | FTB/BRK |
| | 3 | 98 | | FTB/SE1 | 94 | | FTB/SE1 | 102 | | FTB/BRK |
| | 4 | 99 | | FTB/SE1 | 96 | | FTB/SE1 | 104 | | FTB/BRK |
| | 5 | 90 | | FTB/SE1 | 90 | | FTB/SE1 | 100 | | FTB/BRK |
| | AVG. | 96 | | | 93 | | | 102 | | |
| CDS-18 | 1 | 101 | | FTB/SE1 | 92 | | FTB/SE1 | 103 | | FTB/BRK |
| | 2 | 99 | | FTB/SE1 | 83 | | FTB/SE1 | 102 | | FTB/BRK |
| | 3 | 96 | | FTB/SE1 | 84 | | FTB/SE1 | 102 | | FTB/BRK |
| | 4 | 96 | | FTB/SE1 | 85 | | FTB/SE1 | 103 | | FTB/BRK |
| | 5 | 93 | | FTB/SE1 | 85 | | FTB/SE1 | 103 | | FTB/BRK |
| | AVG. | 97 | | | 86 | | | 103 | | |

ENTACT

# Appendix D

Appendix D

# APPENDIX D

# SITE PHOTOGRAPHS

# Progression of Cap Construction

## NL/Taracorp NPL Site • Granite City, Illinois

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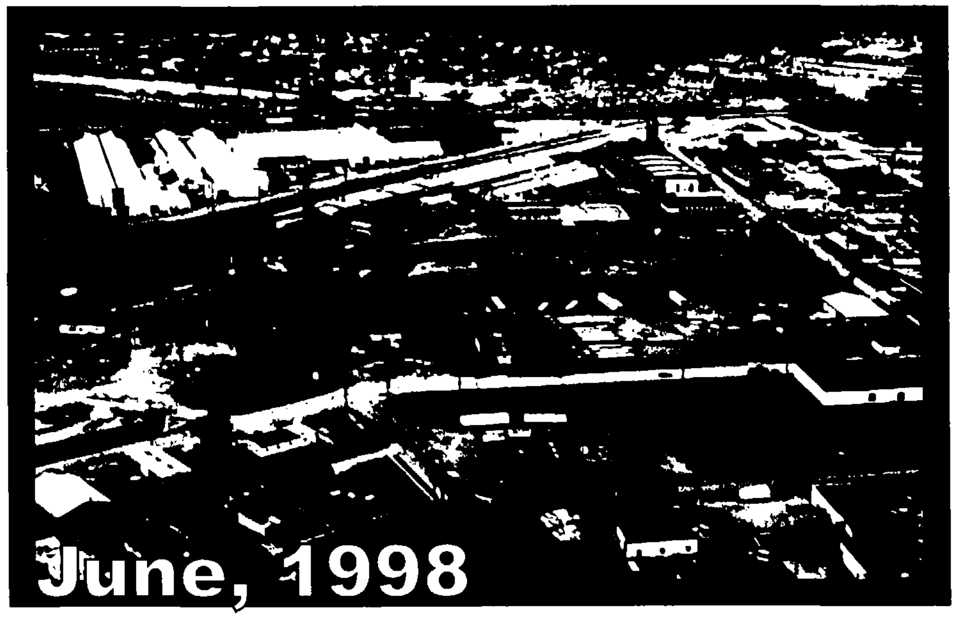
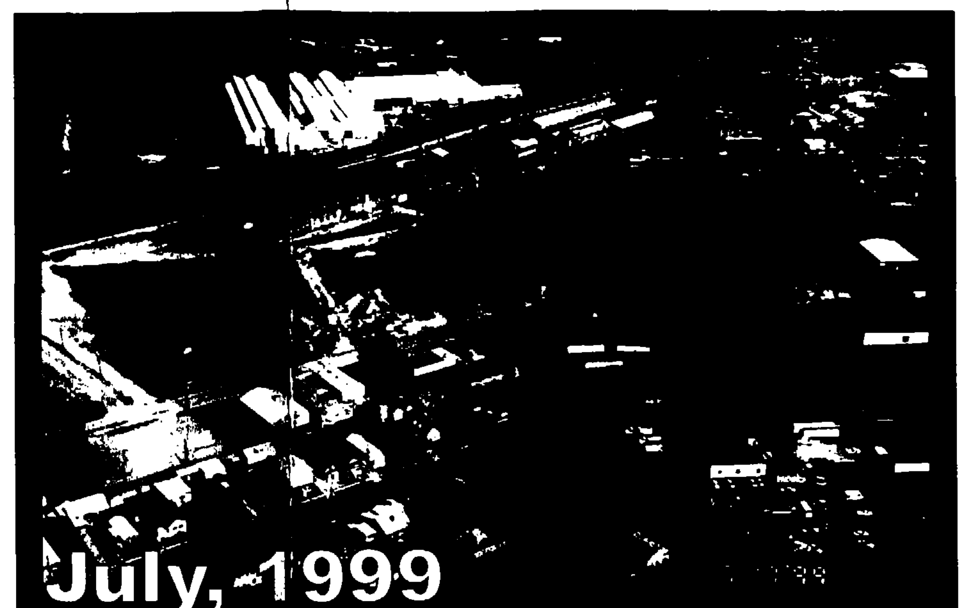

June, 1998


April, 1999


July, 1999


August, 1999


August, 1999


May, 2000